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GAS JOURNAL

LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

VOL. CLXIX. No. 3226.] LONDON, MARCH 11, 1925. [77TH YEAR. PRICE 1s.

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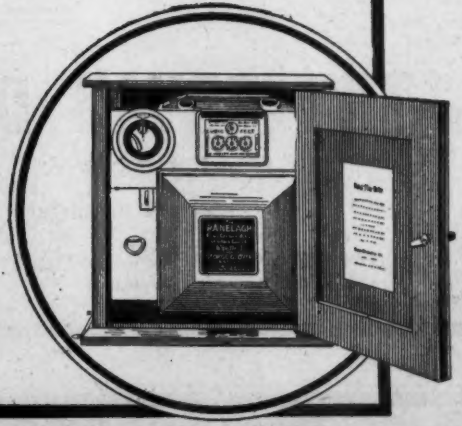

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EDITORIAL NOTES.

Prescience in Distribution Practices.

"No amount of technical efficiency at the gas-works will "compensate for bad distribution." Those words are found towards the end of the Presidential Address of Mr. F. H. Robinson, of Harrogate, to the Manchester District Institution of Gas Engineers. The truth there is in them unfortunately needs repeated emphasis. In these days the efficiency of a gas undertaking, and therefore of management, must be tested not only by the works' results, but by the outcome of practices right away to the place where final efficiency must be judged—that is, at the point of utilization. A combination of factors makes for efficiency at that point; and if there is not efficiency there, then the work upon which there has probably been much concentration at the seat of gas production is largely ruined. As is well known, Mr. Robinson has devoted a large amount of attention to the development of plant having for its purpose the economical manufacture of gas therms; but the address shows that this has not monopolized his consideration, and that distribution and service have been raised to a high standard to the advantage of the undertaking and consumers. We trace in the address the belief that efficiency and satisfaction on the consumers' part are largely to be realized by consistent quality, composition, and pressure conditions. Where these obtain, the intervals between periodical inspection and regulation on the consumers' premises (assuming the existence of the policy) may well be extended, and this would represent an economy. What Mr. Robinson desired to emphasize is the need for foresight in connection with distribution; and he tries to stir our imaginations regarding the future in this respect by picturing the trend of events from his own experiences in the present. It is the only way whereby there can be instruction; and therefore the only way by which there can be legislation for the future.

Reading the address, one has witness to the rapid flights that there are to-day, through variations of winter temperatures, in the consumption of gas owing to its use for heating; the peak loads of cooking hours are seen; as well as the necessity for uniformity in several ways to secure maximum efficiency for the consumers. The ideal condition for distribution would be a uniform demand; but the diverse conditions of our business are such that as it develops there is greater and greater recession from the ideal. This it is the business of the gas engineer to negotiate and provide for; and he has to bring to his aid all that will assist, including the sending out from his works of gas of constant calorific value and composition. Given these conditions in the gas, the next thing is to secure as far as is practicable uniform pressure at the consumer's meter and terminals. This is one of the most difficult of tasks owing to the irregularities of districts and to the fact that present distribution organizations cannot be torn up and reconstructed as one would have them to realize the ideal state. Thus it is that from beginning to end complexities in area and gas demand claim the skill of the engineer to master them, and to defend the business of his undertaking. The President looked upon all these matters with a broad mind and a comprehensive and searching eye.

To follow the interest he imparts would simply mean the reproduction of his address; and therefore we will simply glance at some of his deductions from experience and adopted practices in the attempt to meet the variety of conditions by, within practicable limits, a consistent supply. In this discussion of pressure maintenance, the President is illuminating. Districts vary considerably in respect of levels, and there is the trouble of inconstant demand. The Harrogate district is not immune from difficulties in both regards; but the address shows that provision has been made adequate to giving good pressure in all parts of the supply area. Excepting those concerns which have the misfortune to be working in areas subject to subsidences from mining operations, we have little sympathy with those managers of undertakings who plead that there are parts of their districts to which they cannot give a supply consistent with the requirements of the Gas Regulation Act. It is highly essential that gas suppliers should in these times deal with their distribution systems in the same enlightened manner as most of them are now doing with their manufacturing plant. At the very base of the gas business in these times lies the satisfaction of the consumer; and this can only be realized by the efficiency of supply. It should, therefore, be a cardinal principle of the gas administrator and manager that the adequacy of gas supply should in no wise suffer, and that directly any part of an area, through the development of demand, shows any signs of supply insufficiency, the remedial measures should be taken in hand. Admittedly the question of capital expenditure for this purpose is of considerable importance; but against this one has to weigh the injury to reputation, loss of business, and influence upon competition and future status, to satisfy oneself whether the capital outlay can wisely be withheld.

The President has strengthened the weak points in his district by a high-pressure steel main, feeding into his low pressure system at 3½ to 4½ in. pressure. This main is an instalment of a prospective belt which will run entirely round the town; thus supplying it from the edges towards the centre instead of the old method of running a main axially, with branches radiating from it. Furthermore, instead of having one governor on the works, he has now five on the district—each taking its share of the load. It has been found that these high-pressure governors assist to maintain the pressure in other parts of the district in addition to those portions of the area which the high-pressure main was designed to serve. An interesting point in this connection is discussed by the President; it is as to the best pressure to supply. Of course, in attempting an answer to this, much depends on the design of the burners used in the appliances, and on the composition of the gas. His own experience is that in a hilly district 3½ to 5 in. will give satisfactory results in most gas appliances. There will probably be some dissent regarding this; but it is a fact that the appliances of some of our manufacturers can be made to work quite noiselessly at such pressures. If there are any manufacturers who have appliances with a less range of satisfactory pressure application, they had better look to their future. There is the question of unaccounted-for gas when using pressures such as the President mentions; but here again while the average pressure in Harrogate is 4½ in., the leakage account is under 5 p.ct. Such a position, however, can only be attained by very close attention to both distribution and meters. A matter sometimes overlooked is

that the higher the district pressure, the less is the percentage variation for a given drop in pressure, and thus the better are the gas-fitters able to regulate consumers' appliances. The President instances this lower percentage variation in drops from high pressure as compared with drops from a lower pressure by pointing out that, if the district pressure is 4 in. and the diminution during heavy consumption is ½ in., this is 12½ p.ct.; if the district pressure is 2½ in. a drop of ½ in. would mean 20 p.ct.

There are other influences of which account must be taken to-day in relation to the future of our gas distribution systems, and those influences have to be considered in company with those already discussed. There is practically general agreement that the demand for gas will increase enormously, but that the variability of demand will grow owing to the increase of the heating load. The modern character of traffic and its increase have necessitated new methods of road construction; and this makes road work more difficult for the owners of underground distribution systems. This has been said over and over again; but what is foreseen by those who look forward is that these conditions which are already difficult will increase greatly in severity. This being so, all the arguments that can be applied to a revision of former practices in regard to distribution should have increased weight. In that revision, the President believes that the days of large mains are numbered. There is little reason to disagree with him as one contemplates the heavily tenanted conditions of the sub-soil of roads in populous areas, and considers the advantages (in view of the character of road construction to-day) of laying smaller mains under footpaths. These may be somewhat more costly for a given carrying capacity in respect of capital outlay; but there is compensation in the shortened lengths of services which will be required, and the lower maintenance costs involved. In the long run, it is possible the one will fully compensate the other.

The President took the members into further interest by showing how the weather and the enlarging use of gas fires and cookers affect peak loads, and how necessary it is, in making computations as to future distribution requirements, to have regard to the maximum consumption per hour. In this respect it is clear that, having in view the uncertainties of the factors that combine to produce the maximum hour's consumption, the margin of safety must be on a more liberal scale than hitherto. Then, as to service pipes, Mr. Robinson's experience in Harrogate has led him to put great faith in galvanized steam or heavy galvanized water tubing for the purpose, and nothing less than ¾-in. tube is put into the ground. In this relation, his costs of repairs and maintenance for the last ten years are worthy of study in comparison with those of other undertakings; and it will be found that they fully justify the policy, though other gas engineers will give good testimony as to their practices, and will continue them. The Harrogate Company have also commenced to repair their own meters. In addition, careful scrutiny is made of consumers' cards, and meters are also tested *in situ*. From this work good effects have issued, as is shown by the reduction in the percentage of unaccounted-for gas. The calorific value and the composition of gas supplied the President with further topic upon which to comment. The outstanding counsel in the valuable address, however, is not only that we must look well to the state of the distribution system to see that it is adequate to present requirements, but that there must be broad vision in respect of future requirements.

Waste Effects of Unclean Coal.

It is customary to talk in general terms of the many ill-effects of an excessive percentage of incombustibles in the coal purchased for gas making; but few among us have tried to view the matter in its several aspects and to calculate out—not positively, but approximately—the losses or costs that arise in gas manufacture due to the excess. Dr. Karl Bunte, of Karlsruhe, has attempted to compute on a given basis the costs of an excess of ash in respect of freights, capital, depreciation, maintenance, producer fuel, and wages; but he does not by any means cover the whole ground of loss. To do that would require a large investigation of products, qualities, and other matters. But to the extent that Dr. Bunte goes, he makes out a powerful case for the gas industry insisting on coal being reasonably clean; for what he shows as the loss within the narrow limits of his investigation would, when applied to the whole gas industry of any country, amount to a considerable aggregate sum. To place at 13 p.ct. the ash in an average gas coal supplied in Germany to-day is to have a leaning to the low side; but it suffices for making comparison with the 8 p.ct. prevalent in pre-war days. The 13 p.ct. gives 5 p.ct. increase in ash, which is a convenient figure to take in making an exploration of effects—in this case on the chamber oven plant at the Karlsruhe Gas-Works. There is the practical advantage in this that the data will impress gas engineers with the seriousness of the excess ash, and induce them to look into the matter under their own conditions, on the same lines as Dr. Bunte, and perhaps beyond them. Any capital expended which is not put to a profitable use is a burden on an undertaking; and the excess 5 p.ct. of ash monopolizes the equivalent of two of 48 chamber ovens which cost Mks. 1·9 million; each chamber therefore represents a capital outlay of Mks. 40,000, or 80,000 the two. Upon this sum interest has to be paid. The carbonizing capacity of each oven is 1200 tons per annum. The total quantity of coal carbonized by the whole battery is roundly 50,000 tons, 5 p.ct. of which represents 2500 tons. The waste to the gas undertaking begins at the very start of the journey of the extra ash from the coal mines. The 2500 tons extra ash requires for its transport 250 10-ton wagons, with the cost of freightage, handling, &c. Then as we have shown the equivalent of two chamber ovens is required for a whole year to deal with the extra ash, causing waste of capital, maintenance, labour, and other costs, as well as reducing the over-all efficiency of the ovens. Apart from the reduction of the efficiency of the plant, the direct ascertainable costs due to the additional 5 p.ct. of ash amount to Mks. 109,500. But this does not take account of the depreciation in the value of the coke, extra boiler-house requirements, and additional cost of handling coal, coke, slack, and ash. More details as to Dr. Bunte's calculation will be found later under the heading of "The Importance of Clean Coal."

Abandonment of Common Sense.

Reviewing the industrial news on the Labour side for the past week, the only part of it which shows that common sense has not altogether gone astray in the counsels of the trade unions is the decision of the Executive of the Miners' Federation to agree with the coal owners to the appointment of a Joint Committee to investigate the whole economic position of the industry. That is satisfactory; we hope the result will be to enlighten the Federation as to there being an economic limit to the amount of wages that can be paid per quantum of production. That is the basis to which full regard must be paid; seeing that the home and overseas customers of the coal industry do not purchase on the basis of the time worked by the miners, but per ton of coal. However, the acceptance of the coal owners' proposal for a joint investigation shows wisdom on the part of the Executive of the Federation, in view of the fact that they are now engaged in considering the formulation of new wage proposals for the purpose of a fresh agreement, and both sides have to get at the facts to ascertain precisely what has brought the coal industry to the present position, and what (if anything) can be done to improve it—a position which is causing an increasing number of mines to close down, because there is no profit in them, and therefore augmenting the number of miners unemployed, because there is not a demand for our coal with cheaper coal procurable elsewhere. When we see such an old militant as Mr. Robert Smillie, the late President of the Federation, expressing the wish that an agreed settlement could be reached in the mining crisis which would enable the industry to be conducted on terms fair to both owners and workmen, and saying that he is anxious the industry shall not be wiped out, we feel some satisfaction that the seriousness of the conditions is being recognized by the leaders, and that new light is penetrating into former dark places. But throughout the country there is a feeling that another piece of good work to which the Executive of the Federation might turn attention is to

ascertain whether, in critical times like the present, a flamboyant official such as Mr. A. J. Cook, the Secretary, should be allowed to fly over the country breathing fire, speaking of war and strife, and talking of the overthrow of the capitalist system. Silly and childish behaviour of that kind—manifestly partly due to the limelight that it gains—is not the part of serious leaders. It only makes people treat such persons with contempt, and brings into ridicule the trade union movement. The capitalist system includes the thrifty among working men; its overthrow by hare-brained misleaders of labour would only necessitate its re-establishment pretty promptly in order that industry and employment might go on. Russia overthrew the capitalist system; Russia has appealed to capitalist countries—this one among them—for a loan. Russia killed a vital part of its system; and until that part is restored, there can be little else but misery among the workers of that country. To follow Mr. Cook would be completely to abandon common sense.

This same trade union official sees no hope politically for workers for the next five years, and so he and others—this is the work of the Minority Movement—are proposing to act at once industrially. The way they are doing this is to see what (if anything) can be done to form a new trade union alliance, uniting the powerful miners, railway, transport, and engineering workers' organizations for defensive and possibly offensive purposes. Mr. Cook has had more to say publicly about this movement than any other person. If he and those acting with him succeed in bringing about "arrangements for mutual aid in regard to disputes and set up some machinery so that trade unions can act together when attacked, or in defence," that mutual aid would only be rendered, not at the bidding of the Communist element, but consistently with the will of the majority of trade unionists. The working men of this country have not all taken leave of their senses; and the majority of them are not likely to become the puppets of the Communists. Anyway, according to the voluble Mr. Cook, forty Trade Unions are this week to decide whether or not they are going to join forces in the way proposed; and it is also stated that these Unions represent five million workers. The idea of this combination appears to have emanated from the Miners' Federation. The result of reducing hours in the mining industry to seven is well known. The reduction of output per man-shift has had a deplorable effect upon the industry, and has helped to make the conditions of other industries worse than they would have been had it been possible to secure fuel at a cheaper rate. We are told that, "so far from increasing working hours, the policy of the Federation will be to press forward when conditions are favourable for a six-hour shift." The other Unions who have been invited to step into the combination parlour will see from this that one of the first things they will be asked to do will be to assist in taking action to try to increase the pay of the miners for less output, although the lower output per man-shift under seven-hour working has had such maleficent effects (through its cost) upon the trading position of industries in which the members of the other Unions are engaged. What is wanted is a combination of Trade Unions, not for pressing for increases of wages and reductions of hours when the conditions are altogether unfavourable, but for seeing what can be done to put our industries into a condition to compete in the markets of the world, and so improve employment. But the present policy of the Unions appears to be to endeavour to secure wage increases for those who have employment, while doing nothing to help to make employment for those who are idle. Coincidently, too, if successful in their applications for increases of wages in present circumstances, they are doing something further to increase the cost of living, instead of operating to produce a reduction.

We see this in the new all-grades wages programme of the National Union of Railwaymen—a programme which it is estimated would cost between 30 and 40 millions a year, and yet the railwaymen are receiving better wages to-day than the workers in many of the unsheltered manufacturing industries. To give the railwaymen such an increase would mean that the industries, traders, and travelling public would have to foot the bill. That would be a new burden upon industry and trade, and an addition to the cost of living. Mr. A. E. Rochester, the President of the new Union of Railway Signalmen, states that he has been making a tour of the large railway centres, but has failed to find the slightest vestige of enthusiasm for the all-grades programme and claims. We turn to the state of things in the engineering industry. In this the Unions are claiming a flat all-round advance of £1 per week. Business and employment are bad in the industry, and orders and contracts are going abroad. Nevertheless, the men's leaders absolutely refuse to examine with the employers the conditions of the industry; in fact, they will not agree to, or consider, anything save the 20s. per week. That is their pound of flesh—nothing above, and nothing below. Whether an additional 20s. per week in wages would make the conditions of the industry worse, whether it would create more unemployment, whether it could be given in whole or part by altering the conditions of employment, are not matters which concern the Union leaders. They will have nothing to do with them. If the employers said, "Very well; we must close our works," it would simply be what these so-called leaders and all who place their trust in them richly deserve. The country cannot go along without common sense in all things, which include Trade Union policy.

Coke Competition.

Our contemporary, the "Journal des Usines à Gaz," in the issue for March 5, gives pride of place, as an editorial comment, to the Coke Competition. That the competition has created keen interest in France, we were assured during a recent talk with M. Mougin (whose personality and work in the French gas industry became well known to many British gas engineers last year); and further evidence is to be found in the editorial notice mentioned. "We offer our contemporary," says the Editor, "our warmest congratulations, and ask the 'Journal' to convey the same to the Woodall-Duckham Companies. Great credit for the initiative is merited by Messrs. Woodall-Duckham, whose name is known throughout the world, and whose disinterestedness and work for the gas industry in general will be much appreciated. We are particularly happy to see that the 'Gas Journal' has undertaken to organize the competition. . . . Finally, we would stress the importance and relevance of the subject of the competition, for it covers what is indeed a vital matter to our industry. With a view to improving coke quality and giving satisfaction to a better educated clientele, those in authority must pay as much attention to the coke they sell as to their primary product, gas."

Section III. of the Competition.

One of our correspondents abroad has asked whether it will be competent for him to submit, for Section III. of the Coke Competition, a paper dealing only with utilization, and not sale. The reply is "Certainly," seeing that he may have something to say as to utilization which may be highly valuable in promoting the sale of coke.

A Simple Alarm.

We are much indebted to Mr. Harold E. Copp for the interesting description and illustrations he has forwarded of a simple alarm which he has devised for giving warning should anything untoward happen—through the failure of retort-house governors, or the exhausters suddenly racing—in horizontal retort houses where the hydraulic seal is dispensed with. Such a device will be very useful. It can be adjusted to operate if the vacuum varies as much as one-twentieth of an inch. Mr. Copp has found the apparatus to be most effective in action. The description appears in our "Correspondence" columns.

An Interesting Promotion.

The philanthropic body of promoters operating from 43, Cannon Street, are clearly responsible for another new company, and every applicant for the shares "will, as far as possible, receive consideration." Of that there need be no doubt. The address mentioned above has not the usual prominence in the present prospectus; "County Chambers, Corporation Street, Birmingham," is the Company's registered office. W. Thompson, Esq., the Solicitor, has offices there, according to the particulars given as to contracts; and his London address is stated as 43, Cannon Street. This gentleman has figured in other prospectuses issued from No. 43. As is well known, this group of promoters have a *penchant* for high-sounding titles

for their puny enterprises with big capitals. This new one is the South Midlands and Berkshire Electric Light and Power Company, Ltd. This will provide a good cover for a concern which is to acquire a controlling share, debenture, and administrative interest in the Eynsham Gas Company, Ltd., and to instal electric light in conjunction therewith. Thus the new concern will supply the "area"—not the whole of the South Midlands and Berkshire—with electricity for light and gas for heating, cooking, and power, "which is in considerable demand." It is not stated whether the "considerable demand" is in Eynsham or elsewhere—say, London. However, the resulting electricity and gas revenue is to be pooled as from Dec. 31 last, though apparently the electricity plant is not yet in being. Not a tittle of positive information as to the business or profits is given in the speciously drawn document. We see that the new venture has appropriated part of the title of the "Warwickshire and South Midlands Electricity Supply Company, Ltd.," but that concern does not mind in the least, inasmuch as the offer of the capital in the new Company is made by the Warwickshire Company from their registered address, which happens to be County Chambers, Corporation Street, Birmingham! The financial and guarantee trusts and corporations whose wheels turn at 43, Cannon Street, are kept in obscurity this run. Sir Charles B. Herne Soame (whose name has so delightfully adorned many a prospectus) is enthroned as Chairman of the new Company—a position in which he has done duty in connection with sundry other ventures of the same group of promoters. Reginald H. Smith is also a member of the Board, and so is Alexander Martin—the last-named being a Director of, and the happy possessor of ten shares in, the Eynsham Gas Company. It is all very funny. Part of the present offer of "electric light and gas extensions' capital" is of 9500 8½ p.ct. cumulative participating preference shares of £1 each at par; and these considerate promoters point out that income-tax is free on these up to 4s. 6d. in the pound. It is all highly seductive. In addition to the 8½ p.ct., free of income-tax, these preference shares are to participate as to 10 p.ct. of the remaining net "divisable" [*sic*] annual profits of the joint revenue. If that is not enough to warn people off, then we do not know what will be, unless a few particulars about Eynsham will be more effective. The population is about 1650. The make of gas may exceed 2 million c.ft. a year; the total number of consumers we believe is below 200; and the public lamps reach a grand total of about 30. This is the foundation for the South Midlands and Berkshire concern!

The Promoters and Combination.

There has been much said in our columns that is true as to the advantages of combining gas and electricity supplies. The promoters of the South Midlands and Berkshire concern have (as we have gathered from previous prospectuses) been studying the matter; and they find it an excellent new string upon which to play in inviting the public to subscribe to their precious adventures. Advantages and economies, they tell the recipients of their new prospectus, accrue from combination of gas and electricity supplies to both the consumers and the undertakings. This all depends upon the suitability of the concern and the area. This is the picturesque way in which these promoters present the case: "The utilization of coke produced on the site by the gas undertaking being an economical fuel for generating electricity, the economies effected in the joint electricity and gas working costs will enable the price of gas supplied to be reduced, and its use extended for cooking and heating, and correspondingly enable the price of electric lighting to be also reduced and the demand for power purposes extended—thus enhancing the financial position of both undertakings. The proposed electric light plant installation will be adjoining the gas-works—a saving in capital expenditure on land." It would be highly interesting to put the framers of this prospectus under a little examination on these matters; but probably they would not be prepared to face the ordeal. However, we further read: "By such arrangements the coke fuel can be easily and cheaply utilized and transport costs avoided. It is the opinion of an authority that the supply of electricity and gas being dependable on coal, there can be no question of electricity economically displacing gas as a source of heat in our homes and factories." We know what is meant, but it is vaguely put. Our electrical friends will be pleased to learn from such experts as these that "there is evidence that an established gas undertaking, with its existing buildings, works, plant, labour, management, and organization, can instal with less capital outlay, and generate electricity at a cost which would be beyond the possibility of concerns independently worked." The Electricity Commissioners ought to be informed of this opinion; it might alter very considerably the threatened trend of things.

Gas Workers' Wages Dispute.

In the editorial article which appeared in the "Journal" last week under this heading, it was mentioned that the National Gas Council had circulated a statement as to the events which had led to the development of the present situation. That the document was issued as emanating from the National Gas Council and not the Federation of Gas Employers was solely due to a clerical error. As a matter of fact the mistake was discovered before the "Journal" was published last week; but too late to rectify it in our issue. Accidents will happen in the best regulated families.

PERSONAL.

On the recommendation of the Engineer and Manager (Mr. J. D. Smith), owing to the extension of the plant and the increased gas output, Mr. Frederick Boyd, Engineer, and Mr. Samuel Preston, Electrician, have been appointed Assistant Superintendents in the manufacturing section of the Belfast Gas-Works.

The Blackpool Corporation Gas Committee have placed on record their appreciation of the services rendered to the department by Mr. Douglas F. Irving, the Assistant Engineer, who has been appointed Engineer and General Manager of the Leatherhead Gas Company.

Mr. Ernest F. Hooper, of Messrs. Hooper and Weyman, Newcastle-on-Tyne, and Messrs. G. Waller and Son, Ltd., Stroud, has been elected President of the Stroud Chamber of Commerce.

Mr. John B. Clay, formerly Chief Northern Representative of the Davis Gas Stove Company, Ltd., has been appointed to represent Messrs. Alder and Mackay, Ltd., in the North and Midlands of England.

OBITUARY.

The death occurred on the 2nd inst., in his 93rd year, of Mr. W. D. Joce, the oldest Borough Magistrate of Bideford, who was for many years Secretary of the Bideford Gas Company. His father, Mr. James Joce, was one of those instrumental in the formation of the Company, and was the first Secretary. On his death in 1886, Mr. W. D. Joce succeeded to the position, which he held until 1922.

Bergius' Hydrogenation Process.

A paper by Dr. H. J. Waterman and Mr. J. N. J. Perquin, of the Technical University of Delft, Holland, in which they described investigations into the influence of time on the decomposition of paraffin wax at 450° C. without the addition of hydrogen (cracking), and in the presence of hydrogen under hign pressure (the Bergius process), was presented at a recent meeting of the Institution of Petroleum Technologists. Earlier investigations have shown the favourable influence of hydrogen under high pressure on the process of decomposition which occurs when paraffin wax is heated-up to the temperature named; and in this study the authors claim to have added to the store of knowledge of the "berginisation" process. It is stated by them that, after some hours "berginisation," a larger percentage of gasoline and of kerosene is obtained, while less gas is produced. Coke has not been formed to any material extent. The liquid products of reaction are more saturated. The residue on distillation (boiling-point exceeding 300° C.) after four hours' "berginisation" is but small. On the other hand, in "berginisation" less gasoline (and correspondingly less gas) is formed initially than in the corresponding cracking experiments. In "berginisation" cracking is restricted, and the very reactive residues produced by cracking are converted into hydrocarbons of the gasoline and kerosene distillates. While cracking gives rise to residues poor in hydrogen, "berginisation" prevents the loss of hydrogen. "Berginisation" must be considered as a combined cracking and hydrogenation process. The useful feature of cracking—the breaking-down of hydrocarbon molecules—remains, but is made more regular; while the products are obtained in a more stable condition on account of the addition of hydrogen, so that extensive polymerization and formation of coke are avoided. The main feature of "berginisation" is therefore not the saturation of unsaturated hydrocarbons already present.

ELECTRICITY SUPPLY MEMORANDA.

The Labour-Socialists, we rather think, scent nationalization in the air in connection with electricity supply. Anything which tends in that direction has their deepest sympathy and strongest support; but any electrical plan with private enterprise at its back seems to have the same effect on them as a red rag to a bull. The Labour-Socialists worship super-power stations and joint municipal control; the construction of big stations at the pit-head, and transmitting energy long distances is something over which to go into ecstasies. To talk of the working man's or any other man's wife obtaining electricity for heating instead of using coal or gas fires, doing all her cooking, water heating, ironing, &c., by the same wonderful means, without reference to such a paltry matter as cost, puts new life into these modern electrical visionaries. They would rather it all came to pass (if the days of miracles have not ended) under a municipal order of things than under the auspices of private enterprise—the former would be a step nearer the nationalization goal; the latter a set-back to the Labour-Socialist programme. The members of the Party have had three field days in the House of Commons over electricity within recent times—through four Bills dealing with London and Essex coming forward for second reading. Their efforts to secure rejection of three of them were unsuccessful. These were the London Electric Supply (Nos. 1 and 2) Bills and the North Metropolitan Electric Power Supply Bill—but they were successful in putting an end to the County of London Electric Supply Company's Bill. In this last-named case, however, there were few of the speakers in the discussion who had a good word to say for the Company or their measure; and the speakers represented all parties. There were some who saw that the Bill was an abuse of private enterprise, missing from it the obligations to fulfil a public duty. Others could not see that the scheme would advantage the county of Essex. It was also an unpardonable sin that the Company were not on the King's Roll; and not only so, but according to Lieut.-Col. V. L. Henderson, the Hon. Secretary of the King's Roll National Council, the City of London Committee could get no satisfaction from the Company. Without discussing the merits or demerits of this particular Bill, in our opinion it would be a very bad thing if proposed legislation—assuming it to be beneficial to the public interests—is to be rejected because the promoters are not on the King's Roll, though absence from the Roll is not an honour to any public company.

An Eye to the Future.

"Rights" and the First Steps to Co-ordination.

Whatever substance there was in the opposition case to the London County Company's Bill, the Labour-Socialists could find much less to support their motion for the overthrow of the London Electric Supply (Nos. 1 and 2) Bills. These are an outcome of those protracted and almost heart-breaking efforts to compose the interests of some 81 undertakings in the area affected, 41 of which are in the hands of municipal authorities, and 40 in those of companies. The only way that could be found to begin the development of co-ordination of electricity generation in London was by giving the companies a longer lease of life, with control of technical development by the Joint Electricity Authority and regulation of profits, prices, and dividends by a sliding-scale. The extension of the period of life is forty years—from 1931 to 1971. The Labour-Socialists call this bartering away the rights of the people of London, because they see in it a hindrance to the rapid development of the steps to the achievement of their policy. But as a matter of fact the scheme will not in any way run counter to any plan that the Electricity Commissioners may have in mind for the national development of electricity, although the Labour-Socialist Party think they know better than the experts. The methods that have had perforce to be adopted do not reach the ideal that the Commissioners had in mind; but they are the best that could be found for the ultimate attainment of their ideal—though, true, the day of consummation is far off. While the Labour-Socialists are anxious to get the concerns into the hands of the municipal authorities, or a joint body constituted from them, we are not at all sure that the people of London generally, and the large ratepayers in particular, are at all anxious to see this come to pass. What are the public getting (one Labour Member gravely asked) in return for this giving away of their rights until 1971? It is pretty obvious that, if there is any advantage in technical co-ordination, then anything that can be done in that direction must be beneficial to the public. Moreover, there is to be early interlinking of the efficient stations; and this will do away with the necessity of providing stand-by plant in the same proportion as hitherto, when each undertaking (with two or three exceptions) had to be self-reliant for all emergencies—not always with unblemished success.

An Electrical Sliding-Scale.

Then again there is the sliding-scale which is to apply to the charges and profits of the companies. That surely is a good thing for the public, or the part of the public using electricity. The Labour-Socialists think the sliding-scale means high profits; that it will be injurious to the interests of the consumers; and that it will retard the development of the industry. One of these gentlemen—Major Attlee—positively said that experience of the working of the sliding-scale in connection with gas companies had not been very happy. That is a piece of information which shows (if true, and it is not) that the gas industry has in this matter been living in a fool's paradise. What can be happier than a scheme which only allows an increase of dividend as the price of a commodity goes down? The Electricity Companies concerned are not to be allowed to pay more than 7 p.ct. on their ordinary capital. That is to be the basic dividend. Of any divisible profit beyond, three-quarters of it is to be applied to a reduction of the charges, one-eighth is to go to the employees of the Company, and one-eighth to the stockholders! Thus the consumers obtain the lion's share of the additional profits; and the shareholders a small remnant. How this can mean higher profits, how it can be injurious to the interests of the consumers, and how retard the development of the industry, it puzzles us to tell, and the Labour-Socialists did not trouble to explain. Assumption may not accord with fact; and it certainly does not in this case.

Still Pottering About.

It is remarkable how well some of the Parliamentary Secretaries to the different Government Departments, when speaking in the House, disclose distinctly that they have been primed in the matter in hand, and yet how far short some of them fall from making a good job of what they have to say. In dealing with the case presented by the opponents of the Bills, Lieut.-Col. Moore-Brabazon, for the Ministry of Transport, trotted out the well-worn figures as to the relative consumption of electrical energy per capita in this country as compared with America—an average of 100 units as against 500—but he neglected to explain the reasons which are largely found in the differences in local circumstances. Then he envisaged one or two high-tension cables running from the Midlands to London which would be able to maintain essential service in the event of the ordinary supply breaking down. What the plant would be doing in normal times, and who would bear all the capital and maintenance charges, are points that do not appear to have been worthy of comment. The picture includes four or five big generating stations round London which would carry the actual basic load, while the peak load would be negotiated by eight or ten of the existing stations in London. How in such circumstances the Government or their advisers think cheaper electricity is to be obtained is altogether beyond our understanding, as it is beyond that of some electrical men—perhaps many—who have read the gallant gentleman's statement. We hope the speech does not forecast any intention of the present Government to potter about with this question without considering the matter from the national point of view of the co-ordination of the use of our fuel supplies. That should be fundamental to all else; and the ultimate advantage to the country should far transcend anything which can be realized from the consideration of the electrical aspect only. There are inter-relations between industries which, if developed on proper lines, would have a result of very far-reaching importance to the whole country from both the domestic and industrial points of view. We had certainly hoped the present Government would take a broader view of this matter of the development of our power and heat resources and of national efficiency than their predecessors in office.

Heating an Unwanted Load.

In the "Memoranda" for Feb. 18, allusion was made to a decision of the Hydro Electric Power Commission of Ontario to take a lead in abandoning electric heaters in view of the fact that the load, being intermittent and that seasonal, is not profitable. A contributor to "Electrical Industries," who writes under the heading of "The Electrical Trader," says he "scarcely thinks that the load is one to be distinctly discouraged." He rather feels that perhaps the remedy is to be found in an alteration in the types of heaters. He puts his finger on one difficulty when he says that "there has been a tendency recently, with the increased efficiency and new types of fire-bars, to give big loading—a lot of heat quickly seems to be the aim"—and if this goes on he "can quite sympathize with the station engineers." But he asks, Is the aim of a lot of heat quickly correct? He follows up the question by asking another: Is not low heating kept even all the twenty-four hours better, with separate units to provide local heat, or to boost-up the thermometer on the coldest days? That does not get over the fact that the demand is only a seasonal one, and with our vagarious weather there would still be the "boosting-up" demand on the coldest days, and people generally all get cold together, unless they can have a sufficiency of heat in their homes. Thus our friend's method

would not give any great relief to the station engineer, and it would be more costly than a system which can be brought into use and discontinued at the will of the householder. Furthermore, the expense of the equipment for this dual system would not be very popular. The heating problem is a difficult one for our electrical friends—including the cost of 3420 B.Th.U., or 1-29th part of a therm.

Hire Purchase and Maintenance.

Probably the Electricity Committee of the Hammersmith Borough Council are wise in their proposal to unburden themselves as far as possible of electric appliances on hire by disposing of them to consumers on the hire-purchase system, and then to offer to maintain them at a fixed charge per annum. Perhaps, however, the consumers will prefer the hiring method—if not tired of electrical operation. The offer is apparently a condescension on the part of the Council, for in an electrical paper the chance to purchase hired apparatus is called a "privilege." The proposal is interesting for more than one reason. A joint report has been prepared by the Borough Electrical Engineer and the Borough Accountant, in which it is suggested that apparatus on hire should be depreciated at the rate of 20 p.ct. of the reduced value from year to year, and that consumers should be allowed to purchase their apparatus at the depreciated value, subject to a minimum hire period of twelve months. For instance, a piece of apparatus costing £3 would be sold after the first year's hire at £2 8s., which sum would be reduced year by year to 10s. 2d. at the conclusion of eight years' hiring. After the consumer has purchased a piece of apparatus, the Council would continue the repair and maintenance at a fixed annual charge. The maintenance charges (including repairs) are interesting. They are: For radiators (lamp type), 4s.; radiators (element type), 5s.; domestic irons, 3s.; laundry irons, 8s.; and fans, 2s. By hire-purchasing, the consumer will not be gaining much financially. By the time he comes to the end of the hire-purchase—if he keeps the apparatus in use—the question of renewal will, we imagine, have to be considered.

FUEL ECONOMY.

Excerpts from a Paper read by Mr. E. W. L. Nicol before the Institution of Marine Engineers on March 3.

It has been said that the future belongs to the nation that makes the best use of its fuel resources; and there is no lack of evidence to show that in all important countries of the world there is at the present time great activity in research and development in practice, with a view to co-ordinating fuel supplies and conserving fuel resources. With our smoke and unemployment problems, our lack of petroleum, and the vital necessity for providing independent supplies of liquid fuels for our land, sea, and aerial transport services, there exists in this country every patriotic and material incentive necessary to promote improvement and development in the scientific utilization of our coal resources. The daily increasing extent to which we in this country are in normal circumstances dependent upon the surplus resources of foreign countries for supplies of liquid fuels, and the inevitable consequences of failure to maintain such supplies at economic prices, do not appear to be fully appreciated; and it is doubtful whether the public realize how serious the oil fuel problem is, and how much more serious it may become. That the supply of liquid hydrocarbons from wells cannot support at an economic cost the rapidly growing demands for liquid fuels for many more years is the opinion held by many responsible petroleum geologists.

Low-temperature carbonization and its possibilities, as compared with the high-temperature process carried on at gas-works and coke-oven plants, has recently been reviewed by Sir Richard Redmayne, K.C.B. Taking the last normal year, 1913, 37,483,944 tons of coal were subjected to carbonization, with the result that 20,629,732 tons of coke were produced. Comparing low-temperature with high-temperature carbonization from the viewpoint of bye-products recovery, Sir Richard states that the high-temperature process causes the loss of a great part of the light fuel oils, while the low-temperature process gives a lower yield of benzene and its homologues. On the other hand, under low-temperature carbonization, a much higher yield of light fuel oils is obtained.

One method by which internal liquid fuel supplies might be increased is by the hydrogenation of coal, now known as the Bergius process. Important experiments are being made on this process in Germany, by means of which from 50 to 60 p.ct. of the weight of the coal is converted into valuable liquid products, which include 17 p.ct. of Diesel engine oils. A certain amount of success has attended these experiments; but the difficulty of working with the high temperatures and very high pressures—100 to 150 atmospheres—required by the process must entail high working costs which will make financial success hard to attain.

Another comparatively new system of coal distillation, which has been tried out on a small scale in the United States, is known as the Caracristi (Piron) system.

This system is stated to produce 8000 c.ft. of gas, 10 gallons of gasoline, 20 lbs. of ammonium sulphate, 30 gallons of crude light tar, 3 gallons of creosote oil, 2 gallons of crude lubricating oil, 10 lbs. of grease, and some heavy tar-like oil, the amount of which was not known and its value not estimated, though it is known to be good for fuel, and three-quarters of a ton of coke.

It will be seen, therefore, that coal carbonization is probably the chief source to which we can look for home-produced supplies of fuel oils and motor spirits, if by that process, whether high, low, or moderate temperatures are applied, such fuels can be produced and sold in successful competition with those imported from natural sources. It has been estimated that, if the forty million tons of coal used annually for household purposes in this country were subjected to low-temperature carbonization, a yield of over 2,000,000 tons of fuel oil would be obtained, while the motor spirit produced would amount to about 100,000,000 gallons. All classes of bituminous coal are not, of course, suitable for the production of household fuel by means of carbonization; but the small coke or breeze produced from non-caking coal should find a ready outlet for use as fuel for industrial steam raising, either by itself or in conjunction with low-grade coal.

A fuller utilization of our coal resources by means of carbonization and bye-products recovery may be regarded as one of the most important factors in solving the problem of unemployment through the more efficient use of the land and in the development of the coal-mining industry itself. The importance of the relationship of fuel, food, and fertilizers as an economic factor in the maintenance of our huge agricultural and industrial population, as well as in the defence of the Empire, does not appear to be fully realized.

Attention should therefore be directed to devising processes by means of which bituminous coals of all descriptions may profitably be utilized with a view to produce: (1) Fuel oils suitable for use in internal combustion engines and for steam raising; (2) motor spirit for road and aerial transport; (3) gaseous and smokeless solid fuels for industrial and domestic use. The successful and adequate development of such processes would go far not only to render the country more independent of foreign supplies of liquid fuels, but would tend also to mitigate the coal smoke evil, and would contribute to the more economical working of the coal-mining industry.

The Fuel Research Board have endeavoured to find a substitute for petrol. Of all the possible solutions which have been examined, the most promising is the production of benzole in the gas-works and bye-product recovery coke ovens. At the present time, less than 20 p.ct. of the coal used in Great Britain is treated at gas-works and bye-product recovery coke ovens; and the proposal that no coal capable of profitable carbonization should be used in its crude state is one that should receive immediate attention, if the home production of liquid fuels is to be promoted.

The recent introduction of coke as fuel for steam raising at electric and other power stations, and the development and introduction of coke-burning domestic heating appliances, have together already created an increased demand for coke. For these purposes, not soft coke, but low-volatile gas coke is required for efficient operation; and the potential outlet for coke in this direction may be gauged by the fact that the annual coal consumption for domestic purposes in this country is estimated at 40,000,000 tons, and that for steam raising 60,000,000 tons. In order to cater for the requirements of power stations equipped with coke-burning stokers, relatively cheap non-coking coal, which has hitherto been considered unsuitable, might profitably be used at gas-works, with a view to producing a friable coke or breeze that will not require cutting or grading. Such coal could not be used alone in horizontal retorts, or in coke ovens, but vertical retorts should facilitate its use and thus tend to economize coking coal, which, of all our mineral resources, is perhaps the most precious.

Sufficient has been said to show that the question of promoting the use of coke as fuel for land boilers is closely associated with the home production of liquid fuels for marine propulsion purposes, and, indeed, with the whole question of national economy. Its advantages as a fuel for steam raising are now widely recognized. Coke possesses a relatively high efficiency in combustion, compared with that of coal, and gives in practice a correspondingly high temperature head and radiant effect, both of which are factors of fundamental importance in economic steam raising.

North British Association of Gas Managers.—We are informed by Mr. David Fulton (the Secretary and Treasurer) that the spring meeting of the Association will be held in Edinburgh on Friday, April 3, under the presidency of Mr. James Campbell, of Dunfermline.

Hospital Economy.—To-day the great majority of the London Hospitals (and especially those dealing with tuberculosis) are large consumers of gas for heating and other purposes. Some have two hundred or more gas stoves within their walls. Westminster Hospital, which was recently enlarged and remodelled, has almost this number in use, as is shown in the current issue (No. 132) of "A Thousand-and-One Uses for Gas," which is illustrated by numerous views of its wards, kitchens, nurses' quarters, and so forth.

SCOTTISH JUNIOR GAS ASSOCIATION.
(WESTERN DISTRICT.)

Visit to Johnstone Gas-Works.

On Saturday, Feb. 28, about sixty members of the Western Juniors visited the Johnstone Corporation Gas-Works. Bailie Nicol and Mr. W. A. Dearden (the Manager) received the party. A tour of inspection was then made.

As the retorts at Johnstone are among the first of the Wilson vertical type, the members were specially keen on their examination. The capacity of the retorts is 550,000 c.ft. per day, and the annual output at Johnstone is now 120 millions. There are two holders of a capacity of 350,000 c.ft. and 250,000 c.ft. respectively. A tar-dehydrating and benzole-recovery plant proved very interesting.

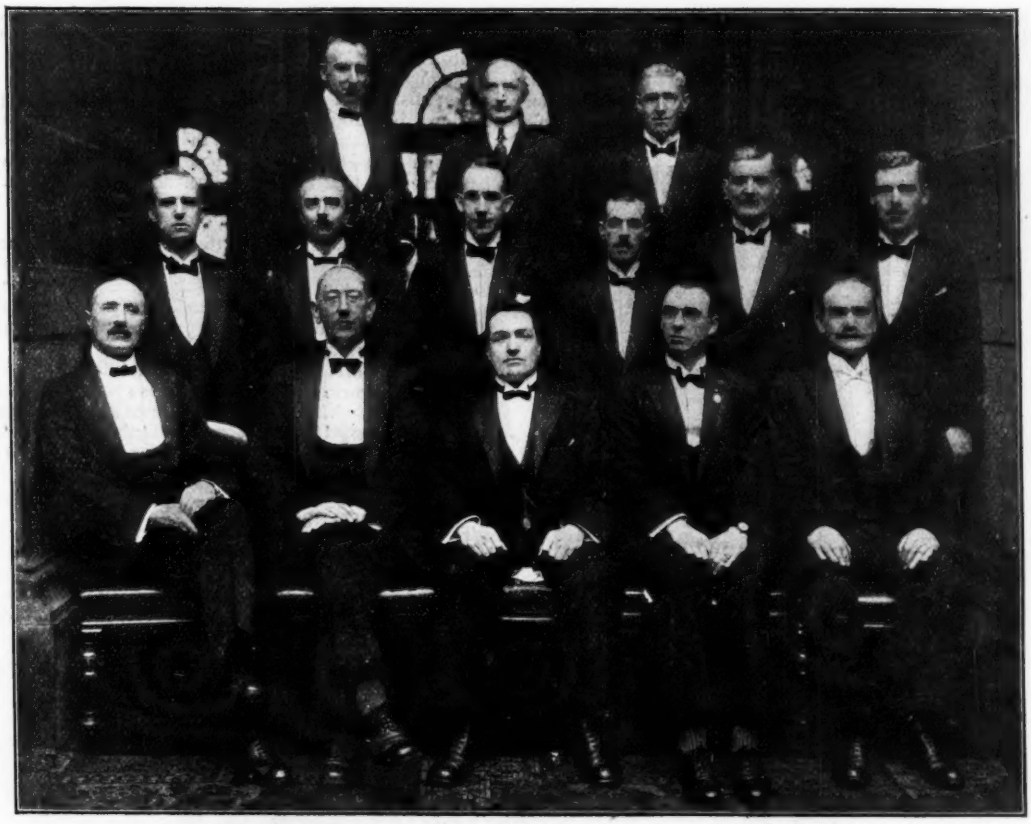
A new suite of offices is in course of erection, with an up-to-date showroom, store, and fitting shop. These extensions were designed by Mr. James Dickson, then Engineer and Manager, and when completed will certainly lead to greater efficiency all round, and give the local consumers an opportunity of examining appliances under working conditions.

After the inspection the party were entertained at tea in the Town Hall by the Corporation.

Bailie NICOL presided; and in welcoming the Juniors to Johnstone commented on the fact that recently they had made a Scottish Junior—Mr. Dearden—their Engineer. He expressed the hope that mutual benefits would result from the visit, and wished the Association prosperity.

Mr. M'ISAAC suitably replied, and conveyed the thanks of the visitors to the Johnstone Corporation and to Mr. Dearden.

The Eastern and Western Juniors will make a joint visit to the tar works of Messrs. J. Ross & Co., of Falkirk, on Saturday, March 14.



PAST-PRESIDENTS AT THE MAJORITY YEAR CELEBRATIONS, FEB. 14, 1925.

FRONT ROW (L. TO R.): J. M'GHEE (Glasgow); J. M'LEOD (Chryston); J. BELL (Dumbarton); J. WILSON, (Motherwell); J. FRAZER (Dalmarnock).

SECOND ROW: A. WALKER (Kilbarchan); J. CUBIE (Glasgow): J. JAMIESON (Edinburgh); J. M'ISAAC (Glasgow); T. MOFFAT (Tradeston); D. FULTON (Helensburgh).

THIRD ROW: A. H. WHITELAW (Dalmarnock); F. L. MACLAREN (Dumbarton); W. LENNOX (Falkirk).

THE IMPORTANCE OF CLEAN COAL.

"Das Gas- und Wasserfach" for Feb. 7 reprinted an article from the "Deutsche Bergwerkszeitung" on this subject, by Prof. Dr. Karl Bunte, of Karlsruhe. In it, he reviews the importance to gas-works of a clean coal, with special reference to the war and post-war difficulties of Germany in this respect, which are now beginning to be removed. The sacrifices which the gas industry was forced to make for the common cause in using whatever coal was available, and the resultant bad gas and hindrance to development of consumers' apparatus have, he estimates, put it back by at least ten years, and left it an unenviable reputation to live down.

To what extent bad coal and the need for increased quantities of water gas affected the quantity of coke available for sale, upon which gas prices so largely depend, is shown by the instance of three important undertakings. Per 100 kilos. of coal carbonized, Berlin had available for sale in 1917-18 only 29·8 kilos. of coke, against 43·3 in 1913; Charlottenburg 34·7 against 44·6; and Dresden 33·8 against 42·4.

Dr. Bunte traces the effect of ash in the coal on the efficiency and wear and tear of settings, and on quality of coke for the open market. Very interesting is his estimate of its effect on working costs. He takes 13 p.ct. of ash as being on the low side for an average in gas coals available in Germany to-day, as against 8 p.ct. in pre-war days. The effect of the additional 5 p.ct. of ash, for the Karlsruhe Gas-Works, is somewhat as follows: The chamber-oven plant consists of 48 chambers, and cost 1·9 million marks. Each chamber represents, therefore, a capital outlay of Mks.40,000. One chamber carbonizes 1200 tons of coal per annum. Taking the total quantity at 50,000 tons, the additional 5 p.ct. of ash amounts to 2500 tons. This means that 250 ten-ton wagons of useless material are delivered in the year, and paid for as coal. In addition there are the freight charges.

	Marks.
2500 tons paid for as gas coal at Mks.20	50,000
Freight at average Mks.8	20,000
2500 tons in the year occupy $\frac{2500}{1200}$, or approx. 2 chambers—*i.e.*, a capital cost of Mks.80,000, depreciation upon which	6,400
Maintenance charges about	2,000
Producer fuel at least 14 p.ct. coke at Mks.30	10,500
Proportion of wages for two chambers.	3,600
Additional producer fuel required for remaining chambers is 1·5 p.ct. = $\frac{50,000 \times 1{\cdot}5}{100}$ tons at Mks.36	27,000
No account taken of depreciation in value of coke for sale, extra boiler-house requirements, and additional cost of handling coal, coke, slack, and ash.	
Additional cost due to extra 5 p.ct. of ash on 50,000 tons of coal, therefore . . . . . =	Mks.109,500

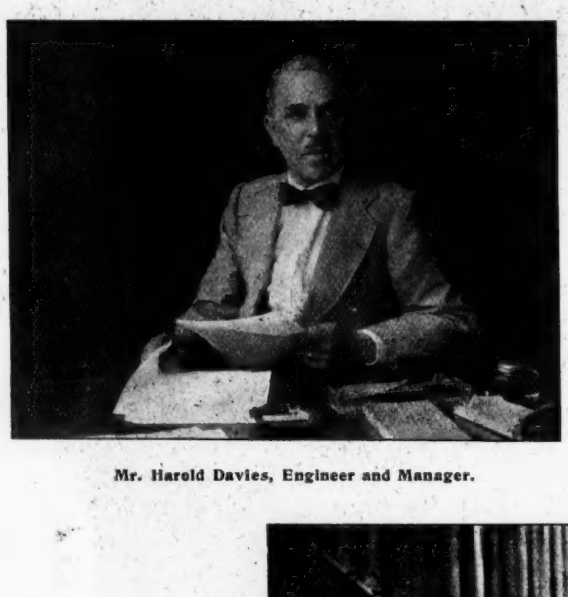
or Mks.2·20 per ton, or, with a gas make of 400 cub.m. per ton [14,125 c.ft. per ton] 0·55 pfennig per cub.m. [roughly 1¼d. per 1000 c.ft., taking £1 = Mks.20].

CHESTERFIELD GAS UNDERTAKING CENTENARY.

INAUGURATION OF NEW CARBONIZING PLANT.

CHESTERFIELD celebrates this year its gas centenary, for it was on May 20, 1825, that an Act to supply the town with water and to light it with gas received the Royal Assent. The occasion was marked on Wednesday, Feb. 25, when the Chairman of the Gas Committee of the Corporation (Alderman G. Clark) entertained his fellow councillors to lunch at the Station Hotel, after which an inspection of the latest improvements at the gas-works was made. The main feature of these is a new carbonizing plant, the contract for which has been carried out by Messrs. Robert Dempster & Sons, Ltd., of Elland; the sub-contractors for the charging and discharging machine being Messrs. W. J. Jenkins & Co., Ltd., of Retford. The Engineer and Manager (Mr. Harold Davies) was cordially congratulated upon the skill displayed by him in adapting old works to modern methods. The following historical notes of the undertaking and account of the new plant, with the illustrations, are taken from a brochure prepared for the celebration by the Borough of Chesterfield Gas Department.

The Chesterfield Gas-Works commenced to supply gas in 1826; and from the first ledger of the Company it appears that the price per 1000 c.ft. then charged was 13s. 6d. The Company continued to supply gas under various Acts of Parliament from 1855 to 1895, when the Chesterfield Gas and Water Board Act was passed, and the undertaking (in 1896) came under the control of that body. In 1920, under the Chesterfield (Extension) Order, the gas undertaking came under the full control of the Corporation. The Corporation possess the powers to supply gas within their own borough, and also within the urban district of Brampton and Walton, and the parishes of Barlow, Brimington, Calow, Duckmanton, Hasland, Temple Normanton, and Wingerworth in the rural district. The development of the output of gas from the works can be gauged from the fact that it has grown from 75 million c.ft. in 1899 to 398 millions now.



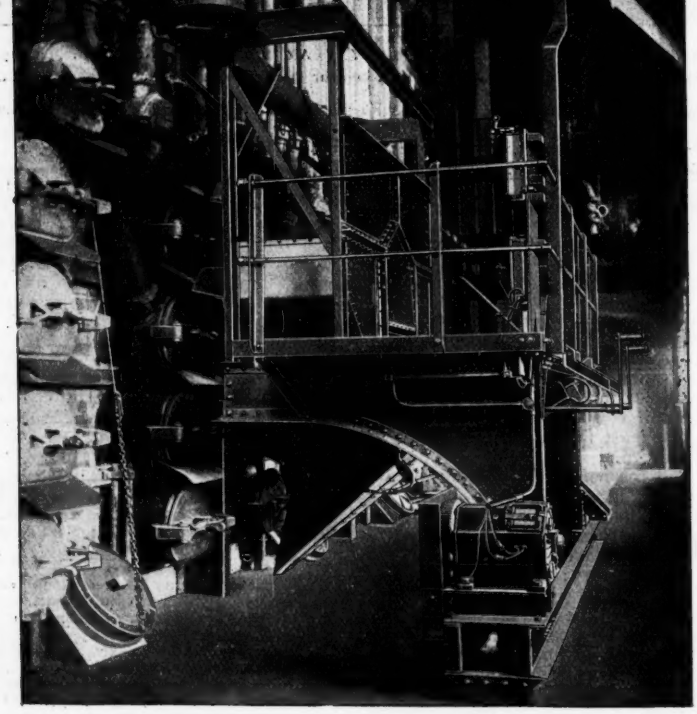
Mr. Harold Davies, Engineer and Manager.

The purchase price of the gas undertaking in 1896 was £116,053, of which sum the gas consumers have repaid £75,915. The total capital of the undertaking has amounted to £322,617; and of this £182,722 has been repaid, or has accumulated in the sinking fund, leaving a net loan debt of £139,895, or approximately £354 per million c.ft. of gas upon the present output.

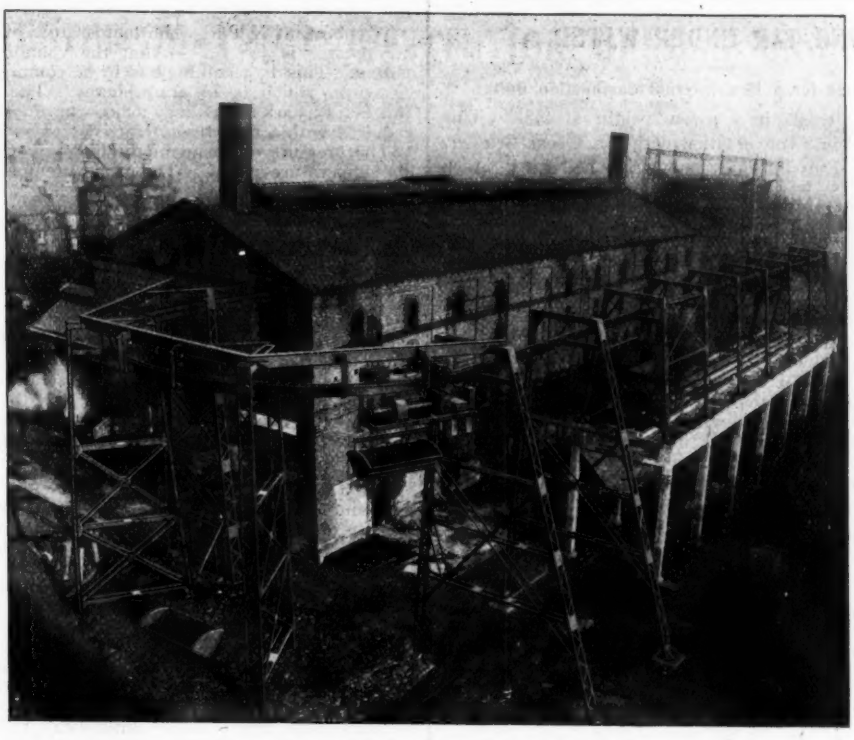
After a hundred years, gas is still made on the original site of the first works. The retort house was extended, and inclined retorts, with an estimated life of twenty years, were installed, in 1898, 1899, and 1904, at a capital expenditure of £23,000, exclusive of coke handling plant, which was purchased at a later date.

THE NEW PLANT.

The new plant, which has been installed upon the site of half the inclined installation, has been erected complete at an approximate cost of £22,000. Forty-two inclined retorts are replaced with sixty of the horizontal type, complete with coal conveyor and bunkers, retort charging and discharging



COKE BUS.



VIEW OF TELPHER AND COKE BUNKERS.

machinery, coke bus for filling furnaces and loading skips, telpher and track for moving coke from the retort house to screens and hoppers, and complete screening plant for coke on rails over six elevated ferro-concrete bunkers for storage and loading purposes.

The coal handling plant comprises overhead steel bunkers to hold 180 tons, with superimposed gravity bucket conveyor electrically driven, for moving the coal, which is delivered from railway trucks through a breaker and elevator to this conveyor.

The carbonizing plant consists of sixty retorts, constructed on the segmental principle, of the finest silica material, to withstand a working temperature, if required, of 1400° C. The retorts are set ten in a bed, and are fitted with self-sealing lids having automatic catches. The gas passes from the hydraulic mains through one common collecting main to a central retort house governor. The stoking machinery is of the De Brouwer type, electrically driven.

The coke bus is adapted to charge the furnaces with red hot coke, and also to convey coke from the upper retorts to the transport skips, without undue breakage and consequent production of breeze. The coke telpher or transporter runs from the retort house to the ferro-concrete coke bunkers. Hot coke is pushed from the retorts into 1-ton skips, which are transported to an elevated quenching tank outside the house, and then taken to the coke screens, which are movable, and run along a track fixed the full length of the coke hoppers. These screens are surmounted by a steel hopper into which the skip of coke is automatically tipped. The coke passes from the hopper through a jig feed to screens which sort it into three sizes. The coke bunkers are six in number, constructed of ferro-concrete to hold 150 tons, and are designed to contain the three sizes of fuel separately in each bunker. At the end of the bunkers, an elevated ferro-concrete tar tank has been constructed to hold 50 tons of tar, to facilitate loading of this material into railway tank wagons.

The Luncheon.

At the luncheon, at which Alderman J. Clark (the Chairman of the Gas Committee) entertained a large number of guests, including many gas engineers from neighbouring undertakings, there was some interesting speech-making.

Alderman W. H. Edmunds (the Chairman of the Health Committee), submitting the toast of "The Chesterfield Corporation Gas Department," remarked that no one would deny that the history of the undertaking was one of remarkable progress on sound economical lines. One reason for this was that they had always had, not only business men on the Committee, but a business man as Chairman, a man of sound ideas. He particularly wished to congratulate the Chairman of the Gas Committee on the fact that he was able to promote the health of the inhabitants of Chesterfield, and at the same time to make money for the ratepayers. He felt sure all the officials in connection with the undertaking would be the last to wish him to leave unsaid anything that could be said about Alderman Clark. He attributed a great deal of the success of the undertaking to the great energy and the business acumen of Alderman Clark, who possessed a quiet determination to carry through any scheme which was for the advantage of the gas concern. In the long run all his schemes were found to be based on sound business lines, and to result in the improvement of the works and economy in their administration. If it had not been for Alderman Clark, the improvements at the gas-works would never have been carried out.

Alderman Clark, in reply, said he would first of all like to express his appreciation of the presence of Mr. J. Ferguson Bell, who was not only a member of the Derby Corporation but also President of the Institution of Gas Engineers. Mr. Bell was filling with credit a position held by a long line of distinguished predecessors. With regard to the gas undertaking, he considered it was a model of municipal enterprise. The Chesterfield undertaking had always been to the forefront in selling to the public a good article produced on sound business lines. As this was the centenary year for gas in Chesterfield, it was well to look back for a moment at the beginnings. Chesterfield had the distinction of possessing a gas supply before gas-works were built. In 1824 an enterprising townsman, Mr. J. Bower, constructed a small apparatus for generating gas, and offered to provide and erect a "handsome cast mettle gass column with a good large gass lanthorn" for £20, and to supply gas for seven months in the year for £7 per season. This gas column was erected at the corner of the Market Place, but was subsequently transferred to the bottom of Packers Row, where it still stands.

Alderman Cropper, in the absence of the Mayor, who had another engagement, proposed "The Contractors." He congratulated the firm on their excellent workmanship and on the reputation they were able to retain in the engineering world after seventy or eighty years of service for the public.

Mr. J. W. Broadhead (Messrs. Robert Dempster & Sons) remarked that he replied to a similar toast in Chesterfield 26 years ago, when his firm put in the inclined retorts. He was glad to know that those retorts were still serviceable and in first-class condition.

Mr. Ferguson Bell gave the toast of "The Gas Engineer." He congratulated Mr. Davies on his skill in adapting old works to modern methods. Anyone could build new works, but it required a skilled engineer to reorganize buildings on an old site, and make them not merely serviceable, but up to date.

Mr. Harold Davies, in the course of his reply, said he wished to acknowledge the great help he had received from the Chairman of the Gas Committee. No one in the country could claim to have a better Chairman, and he was proud to feel that he had his confidence and that of the whole of the members of the Corporation. The new plant would make 1,200,000 c.ft. of gas per day under most economical conditions, and he felt that the expenditure would prove a very sound investment.

A Gas Lecture at Derby.

A very interesting lecture on the gas industry was given by Mr. J. P. M'Crae, of the Derby Gas Light and Coke Company, before the Derby Rotary Club on March 2. After tracing the early history of the industry, the lecturer gave a few facts concerning the Derby Company. In 1924, he said, there was an increase of more than 8 p.ct. in the gas sold, as compared with the amount in 1923. The Derby gas area was some 100 square miles in extent, and there were about 230 miles of mains. Mr. M'Crae concluded by a lucid explanation of the processes involved in the manufacture of gas.

BURNING TAR UNDER WATER.

Remarkable Claims for a New Internal Combustion Boiler.

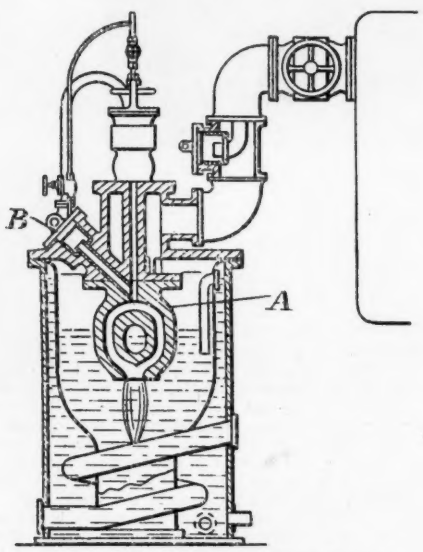
How much energy exists in a given weight of fuel? This question was raised in a conversation with Mr. Oscar Brünler, who has constructed an internal combustion boiler for which he claims efficiencies—based on established formulæ—of over 100 p.ct. Before attempting an answer to this question, it is necessary to set out briefly what led up to it.

Post-War Development.

It is nearly thirty years since the first experiments were made to solve the problem of burning an open flame in liquids, but owing to practical difficulties in applying the idea, and the intervention of the war, the rapid progress anticipated was not made After the war, Mr. Brunler carried out further experimental work, and in 1922 succeeded in building a boiler capable of working continuously and burning liquid hydrocarbons of specific gravities ranging from 0·8 to 1·2. More than sixty different varieties of oil, including tar oil, coal tar, astatki, and waste oil, have been tried; and all these, states Mr. Brunler, can be burned without difficulty.

Operation of the Boiler.

The accompanying diagram shows the steam generator in section.



The Brunler Submerged Flame Burner.

The fuel oil and the air necessary for combustion are supplied to the burner A under a pressure which just exceeds that of the steam. Before starting, the connection valve is closed, and the water level in the generator must not be above the lower mouth of the burner. The cover of the ignition lamp B is removed after heating the fireclay lining of the lamp, and the oil and air ignite on this lining. The cover is replaced, and the flame makes its way to the burner. After a few minutes the main burner is sufficiently hot, and the main regulating valve is opened, and the flame burns in the generator. Then the connecting valve to the water reservoir is opened, and the water rises up to the middle of the burner. The size of the flame, and consequently the quantity of steam, are controlled by the regulating valve, which also keeps constant the ratio of oil and air.

At first the flame, which has a central temperature of 1800° C., gives up the greater part of its heat to the water due to radiation and because of its contact. Around the flame superheated steam is produced which makes its way, together with the products of combustion—nitrogen and carbon dioxide—to the level of the water in the generator, whence the mixture passes to a steam reservoir. From there the steam and gases are taken to an engine which is coupled to an air compressor. For compressing the air in the first instance, an auxiliary compressor operated by electricity is employed, but this is only used for starting-up the plant; the air for combustion when the boiler is working being compressed in the compressor attached to the engine. Hence the cost of raising the pressure at the commencement is negligible, and need not be considered. The mixture of gases which passes from the steam generator to the steam reservoir contains 60 p.ct. of steam and 40 p.ct. of gases. These are the same gases as are employed in gas and oil engines; the only difference being that in these engines the amount of steam is much less.

Compression Costs.

The air required for burning 1 kg. of oil of a calorific value of 11,500 calories per kg. is 17 kg., which has a volume of 13·1 cub.m. at N.T.P. The temperature of the air leaving the compressor is 50° C., so that the volume at 50° C. is 15·5 cub.m. This 15·5 cub.m. has to be compressed to the desired pressure, which is 10 atmospheres. The work required for this is: $15{,}500 \times 10 \cdot 33 \times 2 \cdot 3 = 368{,}000$ kg.m. = 1·36 H.P. The work required with a compressor efficiency of 70 p.ct. is 1·9 H.P.

The pressure of steam in the boiler is 9·8 atmospheres, and its temperature 350° C. The drop of temperature in the engine is from 350° to 80° C. Now according to Carnot's formula, the energy in the oil is:

$$11{,}500 \times 427 \times \frac{T^1 - T}{T^1}$$

$$= 11{,}500 \times 427 \times \frac{623 - 353}{623} = 2{,}117{,}744 = 7 \cdot 82 \text{ H.P.}$$

That is, the engine would, at 100 p.ct. efficiency, produce a total power of 7·82 H.P. Of this, 40 p.ct. is produced by the gases (3·1 H.P.) and 60 p.ct. by the steam (4·7 H.P.). Of this 3·1 H.P., 60 p.ct. can be utilized, so that the power required by the gases is 1·86 H.P. The net power regained is 1·86 − 1·9—in other words, states the inventor, compressing costs are wiped out.

An Unknown Factor.

Owing to the quantity of gases in the engine exhaust, it is not possible to use a condensing engine, but this does not constitute a serious disadvantage. The main idea of the inventor is to save as much fuel as possible, and to obtain the highest efficiency. Mr. Brunler explained to us that, calculating on the basis of present formulæ, he had time after time obtained efficiencies of over 100 p.ct. It was at this point that the question as to whether the means at present employed for determining the heating value of a fuel—*i.e.*, the bomb calorimeter—necessarily gave a correct indication. Mr. Brunler suggested the following explanation of his remarkable figures. A high-temperature flame emits heat radiation and electric vibrations. Normally, the latter, which are capable of piercing water to a depth of 5 mm., are not utilized. When, however, the flame is actually burning in water, these vibrations are capable of splitting-up the water molecule. Immediately the molecule is broken-up, re-combination takes place. This reaction is exothermic, so that, in addition to the heat derived from the fuel, there is the heat of re-combination, which is equivalent to an additional amount of hydrogen in the fuel. According to this, the heating value of oil which is burned under water is the calorific value *plus* an unknown factor, which is a variable. It is not for us to substantiate either the figures or the theory (which seems rather loose) put forward, but they are certainly of interest, and warrant consideration.

Regarding this efficiency of over 100 p.ct., we are in agreement with Mr. R. Wigginton, who, writing in the current issue of "Fuel in Science and Practice," states that "few would believe this statement even if it were supported by a comprehensive series of measurements." Mr. Wigginton goes on to say that, failing an explanation arising from inaccurate work, or the wrongful use of the net calorific value, only three explanations of such an efficiency can be imagined.

1. The inaccuracy of the law of conservation of energy, so that the energy set free during combustion may depend not only on the initial and final states of the system, but also on the exact method of passing from one state to the other.
2. The existence of some hitherto unrecognized form of energy which, in addition to heat, is set free during combustion [*e.g.*, the electric vibrations referred to in this article].
3. The final products of complete combustion might not always be water and carbon dioxide, at any rate in the ordinary form. One might, for example, imagine carbon dioxide to be capable of burning to a higher oxide, let us say CO_4, with further evolution of heat, thus

$$CO_2 + O_2 \rightarrow CO_4$$

Or again, a polymeric form of carbon dioxide might exist (*e.g.*, C_2O_4), formed with evolution of heat from the ordinary dioxide:

$$2\ CO_2 \rightarrow C_2O_4 + \text{heat.}$$

It is also conceivable that two structural isomers of carbon dioxide might exist, the one formed from the other with heat evolution, for instance—

$$O = C = O \rightarrow C \begin{matrix} \diagup O \\ \cdots \\ \diagdown O \end{matrix} + \text{heat.}$$

Similar remarks apply also to the combustion of the hydrogen of the fuel.

At a Royal Sanitary Institute sessional meeting to be held in the Leicester Town Hall on March 27 and 28, a discussion will take place on "Smoke Abatement," to be opened by Mr. F. G. M'Hugh (Chief Sanitary Inspector).

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

Visit to the Works of West's Gas Improvement Company.

The annual meeting of the Institution was held on March 6 at the Midland Hotel, Manchester. Members assembled early; the proceedings beginning with a visit to the works of West's Gas Improvement Company at Miles Platting. Alderman F. J. West, Head of the firm, is Lord Mayor of Manchester, and having cut himself away from business during the current municipal year, was unable to welcome the visitors. The duty therefore devolved upon Mr. Ernest West, who, with others, took them over the entire plant. Mr. Samuel Glover, M.Inst.C.E., whose name has long been associated with that of West in the production of vertical retorts, was also present. It is hardly necessary to say that the visit was greatly appreciated.

DESCRIPTION OF THE WORKS.

We have already described the Albion Ironworks in our columns in full detail [see "JOURNAL," Vol. 164, p. 38]. Photographs were taken of the several parties; and of these we reproduce a selection. Those who visited the works for the first time since the Armistice were impressed by the improvements and extensions carried out in recent years. The works are almost entirely devoted to the manufacture of the steel structural and mechanical portions of the Glover-West vertical retorts; and the extent of the business may be gathered from the fact that there are Glover-West verticals in hand of an aggregate daily capacity of no less than 55½ million c.ft. of gas. The handling of this enormous mass of work is greatly facilitated—indeed, made possible—by the fine organization of the production department, in the particulars and records of which the visitors were keenly interested. The main item of interest was undoubtedly the experimental gas-works and extensive laboratory. Here one of the large new model retorts is installed in a setting designed for experimental purposes. It is arranged with special attachments so that different forms of coke extractors and gas offtakes can be fitted, and is equipped with a detachable producer which can be readily reconstructed from time to time, to try various types and designs of this important part of a retort setting. Coal-gas firing is also arranged for. Steam is raised for the retort and the rest of the plant in a Spencer-Bonecourt gas-fired boiler; and arrangements have been made for the installation of a specially designed waste-heat boiler, which is now in hand. Elaborate provision is made for the weighing and measuring of coal, coke, gas, and residuals; and the works are fully complete with condensing and purifying plant. The laboratory is larger than is found on many big gas-works, and is equipped with all the necessary apparatus for the complete analysis of gas, coal, coke, tar, water, and everything in connection with the chemistry and physics of fuels. Visitors were particularly interested in charts showing results obtained in recent tests, and particularly in a series of tests actually in progress on Durham coals. Durham coals of different calorific values are now being run through the retort, so that accurate information with regard to the behaviour of the material in the retort, and the results to be obtained under varying conditions of carbonization, proportions of steam injected, &c., may be exhaustively studied and tabulated, to form the basis of guarantees.

LUNCHEON AND BUSINESS MEETING.

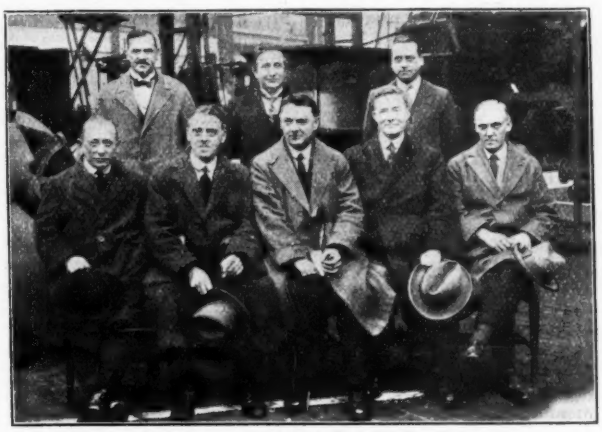
Returning to the Midland Hotel, the members had luncheon together. The President, Mr. G. S. Frith, J.P., of Runcorn, was in the chair. Supporting him were the Lord Mayor (Alderman West) and several ex-Presidents of the Institution.

The PRESIDENT said he was sure they were all delighted to see the Lord Mayor with them.

The following new members were called, and were cordially welcomed by the President: Mr. Chas. R. Ingham, Engineer and Manager, Brighouse; Mr. Harry Curtis, Engineer and Manager, Macclesfield; Mr. William Bennett, Engineer and Manager, Mossley; and Mr. J. D. Ashworth, Greenbank Gas-Works, Blackburn.

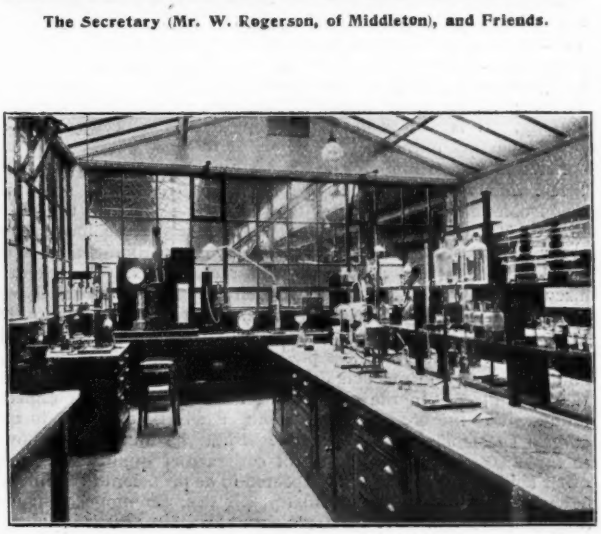
The PRESIDENT then moved the adoption of the annual report and statement of accounts. This was seconded by Mr. S. TAGG, and carried. The report states that the membership now stands at 200. The accounts show a credit balance of £136; but the President explained that the finances of the Institution were not quite so rosy as they seemed, and that,

The President (Mr. F. H. Robinson, of Harrogate), Messrs. W. M. Carr (Stretford), H. Simmonds (Bury), W. Buckley (Droylsden), W. Whatmough (Heywood)



The Secretary (Mr. W. Rogerson, of Middleton), and Friends.

Visit of the Manchester District Institution of Gas Engineers to the Works of West's Gas Improvement Company, Ltd., Manchester.



The Laboratory attached to the Experimental Gas-Works at the Albion Iron-Works, Miles Platting.

after making certain allowances, the credit balance was much more modest.

The Lord Mayor Elected an Hon. Member.

The President, in gracious terms, proposed that the Lord Mayor be made an Hon. Member of the Institution.

Mr. S. Tagg, in seconding the motion, said the name of West was an honoured one in the gas industry, and in no locality was it more highly respected than in Manchester, with which the family had been so long associated.

The resolution was passed with cheers.

The Lord Mayor, addressing the audience as "fellow members of the Manchester District Institution of Gas Engineers," expressed his high appreciation of the honour which had been conferred upon him. It had come to him, he said, as a complete surprise; he had no idea when coming to the meeting that they were going to ask him to accept this honour. Speaking of his recent meetings with civil, electrical, and mechanical engineers, the Lord Mayor said the gas engineer of to-day had to be a combination of all these. He thought it nothing less than wonderful that the gas industry had been able to show so much progress in recent years. It was his hope that trade would soon revive, which would synchronize with a boom for the gas industry. He desired the members of the Institution to accept his invitation to be his guests on Friday, June 26, and to join him in a trip on the Manchester Ship Canal from Manchester to Liverpool.

The invitation was cordially accepted.

Commercial Sections.

Mr. S. Meunier presented the report of the Commercial Section for Lancashire; and Mr. E. H. Hudson (in the absence of Mr. Wood) submitted the report for the Yorkshire Section. The reports were approved.

Committee's Recommendations.

The Committee recommended that the sum of £10 10s. be granted to the Benevolent Fund of the Institution of Gas Engineers; that Mr. F. H. Robinson (Harrogate) be appointed the representative of the District Institution on the Council of the Institution of Gas Engineers for 1925-26, and that Messrs. W. Buckley (Manchester) and W. B. M'Lusky (Halifax) be appointed the representatives of the District Institution on the Councils of the Manchester and Yorkshire Junior Associations respectively. Each recommendation was approved.

Mr. Frith at this stage left the chair, and invited his successor in the presidential office, Mr. F. H. Robinson, of Harrogate, to occupy it.

Mr. Robinson said the first duty was to move a vote of thanks to Mr. Frith for his services as President during the past year.

Mr. R. Watson (Doncaster) seconded the proposal, which was passed with acclamation, and duly acknowledged by Mr. Frith.

The President then delivered his

PRESIDENTIAL ADDRESS.

The office of president of any society is at once an honour and an embarrassment. It is an honour because the person who holds the office has been selected by the whole of the members to be their leader and guide for the year. It is an embarrassment because previous presidents in their addresses have practically exhausted the subjects available, and left the new president with scarcely a plant in the garden.

In the first place, I wish to express my great gratitude to all members for having elected me to the important office of President of the Manchester District Institution of Gas Engineers, the oldest and most flourishing of the District Associations. This meeting is the 200th quarterly meeting of this Institution. I feel the responsibility a very great one, occupying, as I do, the position formerly held by two of my chiefs—the late Mr. Thomas Newbigging and the late Mr. John Gibson Newbigging. It is also a source of pride to me to occupy such a position in my native place.

After looking round for a subject on which to address you, I feel that I could not do better than speak about some of the problems which many of us will have to face in the near future. During the last fifteen years or so, there have been many changes in manufacture, mostly in carbonization, but all aiming at increased efficiency and reduced cost. Papers and discussions on works topics have been very numerous and have shown that the manufacture of gas is becoming more scientific every day. This is particularly true of the larger works, and it becomes necessary in these places to departmentalize the work and put in charge of each department a specialist in the particular subject. In the case of the medium and small undertakings it is the engineer and manager who is expected to be several specialists rolled into one. First, he must know how to make gas economically and of satisfactory quality; but the other subjects in which he is expected to be proficient are almost bewildering. There are chemistry, physics, building construction, mechanics, theory of structures, electricity, book-keeping, the law relating to gas supply, organization, and any other subjects relating to his work which he can find time to learn. I venture to say that no other public official is expected to have such wide knowledge, and in addition to be a good commercial man, as is a gas engineer and manager.

Interesting and valuable as the technical works matters are, I feel that it is the distribution system which should now be claiming attention; and I therefore propose to address you chiefly on certain of the problems of distribution which are confronting some, and will confront others in the future Modern gas appliances require uniform pressure, calorific value, and composition of gas, if consumers are to have satisfaction and if the maintenance staff are to do their work efficiently. The best maintenance system in the world is of little use unless the distribution system will provide uniform conditions.

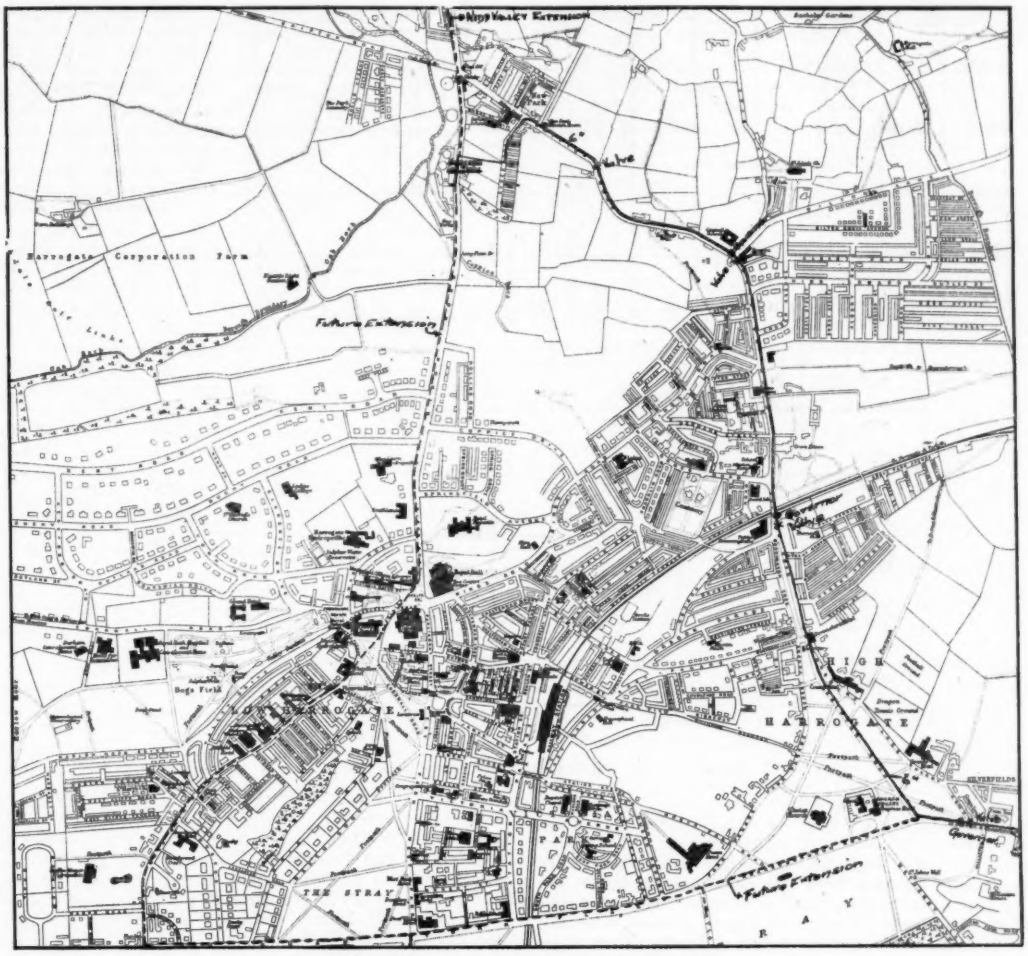
Pressure.

In the first place, we have pressure. The prevailing systems of works governors and large trunk mains laid out on the "tree" method will, I think, eventually have to give way to a system whereby the pressure is automatically governed near the point of consumption. I refer particularly to the high-pressure system with district or service governors. It is little use increasing the pressure at the gas-works if that at the consumer's premises is variable. In all mains a drop in pressure occurs during the periods of heavy consumption. To meet this, additional pressure is put on at the works. The result is that the consumer at the far end of the district may get a more even pressure, but at the expense of the consumer near the works, whose pressure will vary as the load is put on or taken off the governor; and *vice versa*, if the consumer near the works is given a uniform pressure, the one at the far end will be subject to variations. It is in this respect that boosting at the works fails. If mains are not to have more than ½-in. drop in pressure from the works to the end of the district during periods of heavy consumption, they will need to be comparatively large. At one time this difficulty was met by the use

THE PRESIDENT.
Mr. F. H. Robinson, of Harrogate.

of district holders. This is a very useful arrangement where several villages or small towns are supplied from a works in a larger town; but it is not suitable for a populous district. What is the remedy, therefore? It is in high-pressure distribution with district or service governors. The high-pressure mains are run out to the various points in the district; and at these points district governors are fixed and regulated so as to feed into the low-pressure system as soon as the pressure in that system falls below a pre-determined level, which may be 3, 4, or 6 in., so maintaining as near uniformity as possible. In other words, it is transferring the works governor to the place where it is most required—*i.e.*, the district. This system would be applicable to almost all but the smaller undertakings.

We have recently had to face this question in Harrogate. On the north and east sides of the town, the population has increased greatly during the last fifteen years till the mains would no longer afford an adequate supply, especially on Sundays. With a full holder pressure of 5½ in. at the works, the consumers in some parts of the above districts could not get more than 2 to 2½ in. If this had been constant, the position would not have been serious; but no amount of careful regulating of the governor at the works would give a straight line on the chart. The choice, therefore, lay between a larger trunk main running through the affected areas for their own benefit only, or a more flexible system of high-pressure distribution through small mains capable of extension to any part where mains had become overloaded. For the districts mentioned, it was estimated that an 18-in. main would be required for a distance of 3000 yards from the works, reduced to 12 in. for a further distance of 1600 yards. At the time this would have cost £7600, without taking account of all the services to be transferred to the new main and the cost of taking up the old one. This main would have improved the supply in the affected



HIGH-PRESSURE SCHEME AT HARROGATE.

districts without providing for anything in others. Instead of this scheme, we installed two compressors at the gas-works, each of a capacity of 50,000 c.ft. per hour at 15 lbs. per sq. in., and laid a 6-in. steel main with welded joints for the first 3000 yards, reducing to 4 in. for the remaining 1600 yards. Four district governors were fixed *en route*, set to feed into the low-pressure system at 3½ to 4½ in. according to the altitude. This main is intended to form part of a ring of high pressure running round the town, having a diameter of about 1¾ miles, from which branches may be taken to assist more remote districts. The principle will therefore eventually be to supply the town itself from the edges towards the centre, instead of radiating from the centre, as is the usual practice. The cost of the above scheme was £5745, inclusive of all charges both at the works and on the roads. With this scheme, we have saved over £1800, and at the same time provided for the future expansion of Harrogate. The present maximum load is 42,000 c.ft. per hour at 6 lbs. pressure, while the compressors are capable of dealing with 100,000 c.ft. per hour at 15 lbs.

The above scheme has also had the effect of making the pressure in the town more uniform. Instead of having one governor, we now have five governors, each one taking its share of the load. We have also found that the high-pressure governors keep up the pressure in other parts of the district when the large holder is uncupped and we are unable to get above 3½ in. at the works governor.

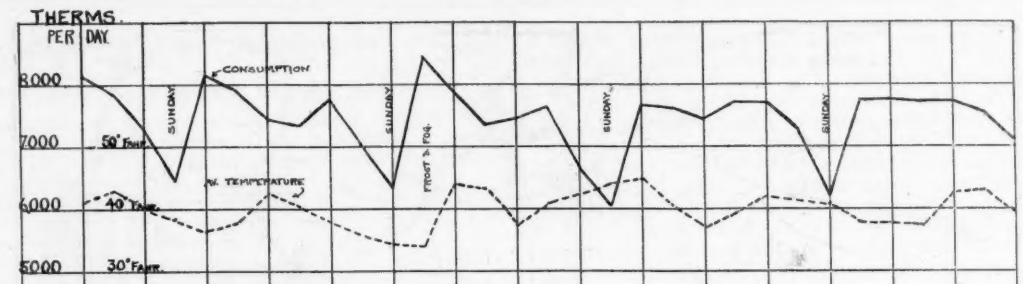
The question has often been asked and debated as to what is the best pressure to supply. Much depends on the design of burners used in the appliances, and on the composition of the gas. Whatever the pressure determined, it should be uniform; and this is one of the great advantages of high-pressure distribution. Our experience in a hilly district is that 3½ to 5 in. will give satisfactory results in most gas appliances. Some appliances are noisy at 5 in., but most can be made quiet at this pressure. On the other hand, there are those who are afraid of giving more than 3 in., for fear of increasing unaccounted-for gas. Our average pressure in Harrogate is 4½ in. in the town, and our leakage account is under 5 p.ct.; and this position has been reached by close attention to distribution, and particularly to meters.

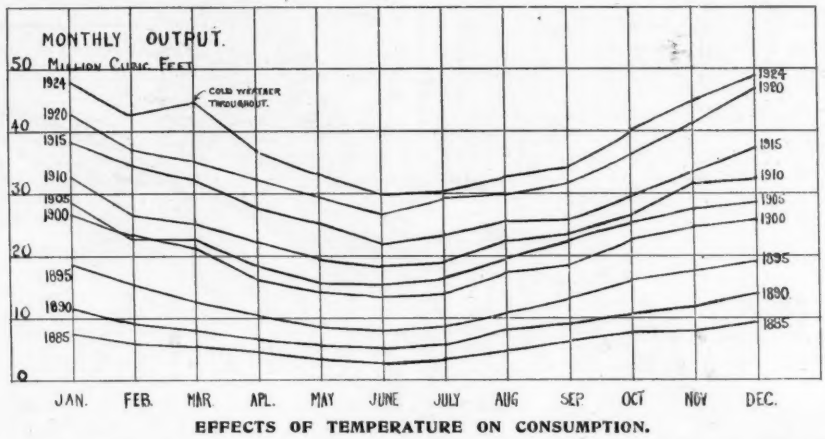
Assume that your district pressure is 4 in. and the drop during heavy consumption is ½ in. This is 12½ p.ct. Now assume that the district pressure is 2½ in. A drop of ½ in. means 20 p.ct. The higher the district pressure, the less is the percentage variation for a given drop in pressure, and the better will the gasfitters be able to regulate the appliances. Most manufacturers have been able to get their appliances quiet up to 5 or 6 in. pressure, but there are still a few who are backward in this respect.

While on the question of mains, there are three other factors which must have a great influence on our distribution system in the future. The first is the increasing number of authorities using the subsoil of our roads, the second is the modern system of road construction, and the third factor is the fewer houses erected per acre. I am of opinion that the day for large gas mains is over. In Harrogate we have two systems of drainage (foul water and surface water), telephones, electric cables (high and low tension), water mains, gas mains, and, in certain places, mains for medicinal waters. Drains and water mains must be of ample size to deliver the maximum quantity required, as no compressing or boosting is possible in these cases. The future policy therefore seems to be to limit the size of the district mains, and run out small high-pressure mains to various points to feed into the low-pressure system. We shall then economize in capital and improve the supply.

Modern Road Construction.

The second factor—modern road construction—tends rather to increase our capital expenditure. In order to deal with the increasing motor traffic, roads are now made wider and of more solid construction. It therefore becomes necessary for gas undertakings to avoid crossing important roads with services or mains, wherever possible, in the interests of road authorities, motorists, and themselves. On such roads, a main on each side becomes a necessity. Though capital cost is increased on mains, it is reduced on services. Take a portion of road 750 yards long and 60 ft. wide between the private boundaries with 100 consumers on the two sides. An 8-in. main is required for this road to supply these consumers and leave a margin for extensions. The cost of the main and services would be about £970. To afford a similar supply, two 6-in. mains would be required; and if laid in the footpaths, the average length of the services would be reduced by 24 or 25 ft. The approximate cost of mains and services would then be £1050. Though the first cost is greater, the maintenance cost which follows will be less with the system of double mains, and consumers will be assured of a more satisfactory supply with the shorter services.





EFFECTS OF TEMPERATURE ON CONSUMPTION.

PEAK LOADS.

With the increased use of gas for heating and cooking, another factor has to be reckoned with in laying out a distribution system—viz., the maximum consumption per hour. In the old days when lighting was the principal business, the maximum consumption was spread over many hours on the darkest day of the year. Conditions are now very different. The maximum load will often be found to occur from 11.30 a.m. to 1 p.m. on Sundays, while in some places, such as industrial districts, the maximum load will be found to occur round about breakfast time on a cold winter morning when lights, gas fires, cookers, and grillers are in full use. In some cases the maximum load comes on at mid-day, and in others in the early evening. In Harrogate we have two such periods in the winter—noon to 1 p.m. and 5 to 6 p.m., and in each of these hours one-fourteenth of the total output for the day is turned out.

In a residential district like Harrogate, where gas fires are popular, weather conditions play an important part. The chart reproduced shows how the temperature influences consumptions. We have frequently experienced an increased consumption from 1½ million c.ft. on one day to 1¾ millions the following day, due to a sharp frost. If a Sunday is mild and Monday is very cold, the difference in consumption will be as much as 400,000 to 500,000 c.ft. instead of 250,000 c.ft.

The upper chart shows the consumption each day of January, 1925. If the consumptions and temperatures of each Sunday, Monday, or any other day are compared, the influence of the weather is seen. This is particularly noticeable on Monday, Jan. 12, where the lowest temperature is accompanied by the highest consumption. The lower chart also illustrates this by the peak in March, 1924. During that month the average night temperature was 28° Fahr.

It might be thought that in a town like Harrogate, with its visitors and a large resident population, the summer load would be high proportionately to the winter load. On referring to the bottom curve, you will see that it is fairly flat and very regular. It would naturally be assumed that the increased use of gas for cooking, and the competition of electric light since 1885, would have flattened this curve still further; but on looking at the top curve, for 1924, it will be seen that the slopes at the ends are very much steeper than in 1885. Thirty years ago the difference in consumption between January and June was about 11 million c.ft., while it is now about 19 millions. This change is due entirely to the development of the heating business, especially in gas fires.

The growth of the gas-fire business has been very marked. Since the end of 1918, we in Harrogate have sold a large number of gas fires, as the list shows:

Year.	Gas Fires Sold.
1919	640
1920	660
1921 (coal strike)	539
1922	708
1923	768
1924	762
Total	4077

In addition to these, there are cookers, geysers, radiators, &c. For these six years the total number of gas appliances sold by us is 9138. Since 1910, when the gas fire with pillar fuel came into favour, we have sold in all 14,610 gas appliances, and in addition there are 5676 stoves on hire. With 10,878 consumers in our district, and a total of well over 20,000 gas appliances in use, probably more than one-half of them for heating, it will be realized that a sudden change in the weather, from warm to cold, can be somewhat disconcerting at times, though welcome in respect of increased business. It is at such times as these that boosting by high-pressure feeders and district governors proves very useful, as the latter take up the load and give the necessary pressure where it is most wanted—in the district, and not at the works.

Before leaving the subject of mains, I would like to express my appreciation of the work done by Mr. Stephen Lacey on this subject, and for having recently published very useful rules and tables for calculating the discharge of gas mains and pipes [see "JOURNAL" for June 18, 1924, p. 817].

SERVICE PIPES.

The question of service pipes is one which often receives but scant attention, though it is well known that bad service work means a poor supply and high leakage. It is to be hoped that there are no managers to-day so short-sighted as to put in the ground "black" iron pipes of ½ in. diameter, even though the soil is good. For several decades the Harrogate Gas Company have used nothing but galvanized steam or heavy galvanized water tubing for services, and nothing less than ¾-in. tube is put in the ground. This custom was commenced in the early days of the Company's existence, in order to resist the action of mineral waters from the various springs in the district, but the rule applies to our whole area of supply, whether near the springs or in the outer districts. This may appear extravagant, but the following figures will show that the policy has been a wise one. The cost of repairs and maintenance to mains and service pipes for the last ten years is shown in the following table, compared with the average of 116 undertakings. These figures are extracted from the "Gas World Analyses of Accounts."

Year.	Harrogate.	Unaccounted-for Gas.	Average 116 Undertakings.
	Pence per 1000 C.Ft. Sold.	P.Ct.	Pence per 1000 C.Ft. Sold.
1915	0·14	5·8	1·28
1916	0·05	7·7	1·00
1917	0·03	7·3	1·02
1918	0·13	6·1	1·09
1919	0·40	7·9	1·49
1920	0·36	9·6*	2·30
1921	0·50	7·8	2·71
1922	0·32	7·3	2·84
1923	0·41	5·7	2·64
1924	0·43	4·2	—

* The high figure of 9·6 p.ct. for unaccounted-for gas in 1920 is due to an adjustment in slot meter consumptions at the end of that year, on account of cash remaining in meters.

A further examination of these "Analyses of Accounts" will show that our costs for repairs of mains and services are the lowest in the list. It might be said that we do not renew them often enough; but when I tell you that in the eleven years I have been with the Company I have not known of more than three service pipes having to be renewed for corrosion, and that our unaccounted-for gas is now only 4·2 p.ct., it is proof that the distribution system is in good order, notwithstanding a district pressure of 4 to 5 in.

It is interesting to note that the average cost of repairs to mains and services for company undertakings for the above nine years is 1·35d. per 1000 c.ft. sold, against 2·28d. for municipal undertakings. In some districts where the soil is acid in character there are gas undertakings using service pipes coated with bitumen and wrapped in a similar manner to steel mains, the object being the same as using galvanized pipe—to give the pipes as long a life as possible. Parsimony in laying mains and services means nothing but trouble and loss of business in future years. Many of the complaints received, particularly in districts supplied from small works, are due to mains and services of insufficient capacity and poor quality, through committees and boards of directors in these places having a wrong idea of economy and a lack of foresight.

The Gas Regulation Act, with its provisions as to minimum pressures, should do much to effect an improvement in many districts. There are, no doubt, in hilly parts of the country, places which are difficult to supply with 2 in. as a minimum; and in such cases special provisions would have to be made. In the great majority of cases, however, it cannot be seriously urged that such a minimum is a hardship. It is surely a contradiction that on the one hand the use of gas for heating, cooking, and lighting should be pushed on all sides, while on the other consumers are subject to variations of pressure as much as, perhaps, 30 p.ct. It is little use a gasfitter regulating appliances in the daytime when the pressure is (say) 3 in., and then, during the evening or at midday on Sunday, the pressure falls to 2 in. or less. During the last few years, enlargements of mains had to be suspended; but if business is to be retained and extended, it is essential that the distribution system should be in good order and able to meet the peak load with a reserve for expansion.

The policy of my Company for over forty years has been to keep the distribution system in good condition and adequate for the needs of consumers, by laying mains and services of sufficient capacity to deal not only with the immediate requirements, but to provide for the future; and I have had reason to be thankful for this wise policy during the war years, when the rich gas of 600 B.Th.U. was reduced to as low as 430 B.Th.U. In spite of the comparatively high average pressure which we carry—4½ to 5 in.—and of the fact that we have very long lengths of main by the Stray and through country districts with very few consumers, our unaccounted-for gas is low, and we are able to give a good supply to the limit of our mains, some six miles away. Our mains extend eight miles from East to West, and six miles from North to South, with a total of 84 miles, much being laid through open country.

METERS.

Unaccounted-for gas is often assumed to be due almost entirely to the condition of the mains and services, and other factors are overlooked. I refer to condensation, differences in temperature between the station meter and consumers' meters, and the condition of the last-named. "The Life of Gas Meters Committee's" Report on unaccounted-for gas, presented at the Institution Meeting in October, 1918, by Mr. B. R. Parkinson, drew attention to these factors, and mentioned that much of the leakage was due to consumers' meters. It was there stated that ¾ p.ct. could be written off for temperature corrections, 1 p.ct. for leakage, and ¼ p.ct. for station meters fast. Out of a figure of 7 p.ct. for unaccounted-for gas, 5 p.ct. is then left to the meters. So long as the meter is registering, it is often taken for granted to be in order. Careful scrutiny of the meter cards as they come in, and a test in cases where a reduced consumption is recorded, will result in a surprising number of meters being found to register slow. Also, meters left unchanged in houses after additional apparatus has been fixed are another source of loss. It is somewhat expensive to do this all round, but in the end it must be the wisest policy.

The increase in unaccounted-for gas in Harrogate from 1916 to 1922 was attributable entirely to the condition of consumers' meters. During the war there was great difficulty in obtaining new meters and getting repairs done; and in the few years following the Armistice these difficulties increased. In April, 1922, we commenced repairing our own meters, and followed it up with more careful scrutiny of consumers' cards and testing *in situ*. The result has been that faulty meters are changed more rapidly, and meters which are too small for their work are more easily found. The reduced percentage of unaccounted-for gas during 1923 and 1924 shows the benefit obtained from this policy.

While on the question of unaccounted-for gas, it might be of interest to you to know of a method we use in Harrogate of jointing steel mains with long sleeve and rigid joints. Before driving in the spigot end of the main, it is painted with red lead, and about eight or ten turns of string of suitable thickness are wrapped close round the spigot, and also painted with red lead. The pipe is then driven home into the long socket, making the joint practically gas-tight before it is caulked.

CALORIFIC VALUE AND COMPOSITION.

These two items must be considered together. Most of us have experienced variations in the behaviour of gas in incandescent burners on different days when the tests for calorific value made on these days show very little difference. The variation is due to changes in composition and density of the gas. These variations are most noticeable in districts where carburetted water gas is supplied, and are the result of irregular working of the carburetted water gas plant. Where such a plant is used merely for controlling the residuals market or as a plant for taking up the peak load in times of heavy consumption, there is bound to be trouble with consumers' fittings, owing to the changes in composition. Whatever the policy of an undertaking, whether straight coal gas or coal gas *plus* water gas, constant composition can only be obtained by keeping constant the proportions of coal gas and water gas within reasonable limits. Take a works supplying 480 gas. With the market in residuals weak, and coal dear, the manager would decide to make more water gas, up to as much as (say) 30 p.ct. A change in the prices of residuals might tempt him to increase the quantity of coke, tar, &c., for sale. He can only do it by reducing the percentage of water gas, and so he promptly reduces it to (say) 10 p.ct., and if he cannot get low enough in calorific value with only 10 p.ct., he has to begin overpulling. The composition of the gas is now very different from what it was with the 30 p.ct. of water gas; and complaints will come in, though he may still be supplying 480 gas. To be constantly varying the composition of the gas to suit the coke and tar markets may appear expedient from one point of view, but it is asking for complaints from the consumer, in face of keen competition. The conclusion is, therefore, that, having determined the proportions of water gas and coal gas, and the calorific value to suit the district, these should be adhered to until circumstances necessitate a revision of the policy, and no change should be made for a lengthy period. In this connection, there is a point to bear in mind. The lower the thermal yield of gas per ton of coal, the more unstable is the price of gas, owing to the greater influence of the prices of coal and residuals. We have recently experienced this in connection with tar, and are likely to experience it with coke. If stability is desired, the policy is to make oneself less subject to these market fluctuations by reducing the amount of coal carbonized and the quantity of residuals for sale.

There are many more interesting points in distribution which cannot be mentioned for lack of time, but there is one subject upon which I should like to say a few words—the co-operation of gas and electricity undertakings. Think of the waste going on with electric power stations consuming raw coal in an inefficient manner—while they could obtain a clean gaseous fuel from the gas-works and enable the latter to recover the coke and tar—and installing large boiler plants in addition to their generating plants when, by substituting gaseous fuel, they could reduce their capital expenditure at the station considerably, and also their labour costs. Reliable gas engines of suitable size for all but the very large generating stations can be obtained. I feel sure that it is mostly prejudice which is standing in the way of co-operation between the two industries—a co-operation which would be of mutual benefit. As an example there is Buxton, where a loss of £4000 a year on the electricity undertaking was converted into a profit of £3000 a year after changing from steam to gas; and they now have a large building, which formerly housed the boilers, standing empty, and available for future extensions.

In choosing the subject of distribution for my address to you, I have been influenced by the thought, which becomes insistent, that, if gas is to be the fuel of the future, the distribution system must be so laid out, and the quality of gas so constant, that the consumer shall have no cause for complaint. No amount of technical efficiency at the gas-works will compensate for bad distribution. Great as the changes have been in carbonization lately, in the direction of increased efficiency, these will be neutralized unless the consumer is to get that uniform pressure, calorific value, and composition which are necessary if he is to make the best use of his appliances. If he cannot be assured of these conditions, the work of the maintenance fitters is wasted, and his consumption will ultimately be lost. While the use of electricity for lighting is increasing, the use of gas for heating, cooking, and industrial purposes is extending at a greater rate than ever; and unless we attend to our distribution systems, we shall miss the tide at the flood.

The cordial thanks of the meeting were tendered to the President for his address, on the motion of Mr. R. E. GIBSON (Liverpool), seconded by Mr. J. H. BREARLEY (Southport).

The PRESIDENT, after acknowledging the vote of thanks, said he was the bearer of an invitation from the Harrogate Gas Company for the Institution to hold their next meeting, on Friday, May 22, at Harrogate.

This invitation was heartily accepted.

Thanks were accorded to the Secretary and Committee for their past services, on the proposal of Mr. BREARLEY, seconded by Mr. F. SIDWELL (Winsford).

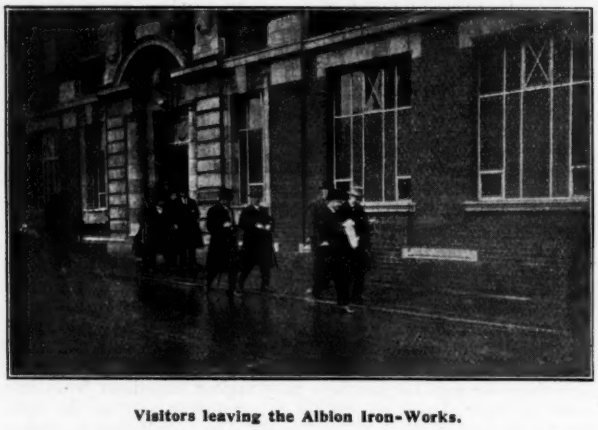
On the motion of the EX-PRESIDENT, the thanks of the Institution were passed to West's Gas Improvement Company.

A RESOLUTION.

Mr. S. MEUNIER (Stockport) submitted the following resolution, which had been passed by the Lancashire Commercial Section, and asked the meeting to adopt it: "Having regard to the national importance of the gas industry, and particularly to the service it renders in conserving the coal supplies of the country, this meeting views with concern the reported proposal of the Government for financial assistance for the electricity industry, and urges the National Gas Council to take such steps as will ensure the full consideration by the Government of the claims of the gas industry, and suggests that all undertakings should be advised at some opportune time to appeal for the support of Members of Parliament representing the districts within their area of supply."

Mr. R. H. GINMAN (Leek) seconded the motion, and cited an instance of unfair favouritism towards electricity in the Leek district. Electricity had there been granted an extension of its area without let or hindrance—a privilege which was denied to gas.

The resolution was adopted.



Visitors leaving the Albion Iron-Works.

Visitors waiting for the Special Cars.

THE IDEAL HOME EXHIBITION.

Many Gas Appliances.

(*Continued from p.* 526.)

As will have been anticipated from the account of it which appeared in last week's "JOURNAL," the London Gas Exhibit is proving a great attraction at Olympia. Amid many beautiful things, no one is likely to pass over a display so beautiful as this. Gas at its best—as it is here—can command attention anywhere and at any time.

The attendances at the exhibition—particularly after 6 o'clock, when the price of admission is halved—are extremely gratifying, and there is plenty for all who may go to see and admire. "England's Glorious Gardens," in the annexe, are in perfect condition, and, with their delightful little Japanese tea garden, are in themselves more than sufficient recompense for a journey to Olympia. The opportunity for reaping this reward lasts only until March 25.

Further Gas-Fitted Houses.

The under-mentioned model homes, in addition to those detailed in last week's issue, are equipped with gas-consuming appliances.

Concrete House of the British Portland Cement Association.—In the kitchen is installed a Parkinson "Holborn" cooker, on white enamelled top stand, fitted with plate rack and enamelled back. Hot water is provided by a Parkinson "Holborn" circulator. Living and bed rooms are equipped with Parkinson "built-in" fires, in handsome surrounds, with mantels and hearths of artificial stone. The effect is artistic and pleasing.

Messrs. Y. J. Lovell & Sons.—A Parkinson cabinet cooker and special washing copper are in evidence in the kitchen of the model house erected by this firm. The bathroom is equipped with a Parkinson-Maughan geyser, in black nickel finish. We notice here, again, Parkinson "built-in" fires (including one of their latest designs—namely, the "Ripon"). The artistic manner in which the "built-in" fire is fitted in a corner of the study is particularly striking and effective.

Messrs. Richard Costain & Son.—The house erected by this firm is similarly equipped to those already described. Here also are Parkinson's appliances to be seen. We have before us a special leaflet published by the Parkinson Stove Company descriptive of gas heating appliances for housing schemes. The Company obviously understand the needs of these schemes, and have set themselves adequately to meet them.

Stimex Specialities.

A comprehensive display of gas cookers, ranges, circulators, and fires is made by the New Stimex Gas Stove Company, Ltd., of Stimex House, Balham Hill, London, S.W. With these stoves, the oven burner is outside the oven, so that the latter is entirely closed in. The "Queen" cooker is now well known, and can be had on stand or on the "eye-level" principle. A feature is the gas combination range, which is a cooker, fire, and "University" circulator combined. Demonstrations are being given daily during the exhibition.

The firm's "Dainty" gas fire is a small portable appliance, which can be carried from room to room, and is specially designed for bedroom and for study use. The main principle on which it is designed is that of breadth, not height. A flue outlet is provided so that the products of combustion may be directed to the chimney. Various patterns of gas fires for permanent installation are also made by the Company.

Flavel Cookers.

The latest pattern of Flavel "Leamington" cookers is shown by Mr. Ernest A. Denyer, of No. 1, Marylebone Road, London, N.W. Readers are acquainted with these cookers, which have hotplates of special design, and are provided with either single or double type Flavel burners. One principle of the construction of this burner is to make an efficient mixture of gas and air by circulating these elements in a peculiar spiral motion, which produces perfect combustion on ignition. The system of perforated jets has been discarded, and the gas flame issues in a complete circle of solid flame. The Flavel double burner gives a flame of great heating value for quick boiling. Its advantage is that, while it is a very powerful burner when used at its full capacity, it can be employed as a single burner, either as a small circle or as a large one, for the two taps which control the double burner can be operated independently.

Enamelled Steel Cookers.

Constructed mainly of pressed steel, and finished with a hard vitreous enamel, with the bright parts heavily nickel plated, "Anti-Waste" cookers have a novel and pleasing appearance. The hotplate burners are constructed to ensure that the correct amount of air is admitted under all conditions for the complete combustion of the gas. There is a small ring flame within the larger one, both being controlled by the same tap. The gas taps for the ovens are fitted with an automatic locking device, to prevent the gas being accidentally turned on. Anti-Waste Appliances, Ltd., of No. 20, St. Paul's Churchyard, London, E.C., have a combination coal range and gas cooker, designed to meet the case of a house where space in the kitchen is restricted, but the tenant desires to have both coal and gas cooking apparatus available. The firm's column gas radiators, with the heating pipes enamelled in white, are attractive.

A Boiler and Cooker Combination.

Several sizes are shown by Messrs. Robert Jenkins & Co., Ltd., of Rotherham, of the "Eco" combination, which consists of the linking-up of a coke or anthracite water boiler with a gas cooker. The boiler is heated in the usual way, but instead of the hot gases being allowed to pass out direct through the flue, they are first circulated round the oven of the cooker which is placed by the side of the boiler. This maintains a steady temperature; but should the heat not be sufficient for baking purposes, the gas supply may be turned on for a few minutes until it is. A hinged hotplate is provided, so that, for boiling, either this or the top of the oven heated from the boiler may be used as desired.

The "Smoothtop" gas range is exhibited by the Lawson Manufacturing Company, Ltd., of No. 31, Gifford Street, Caledonian Road, London, N., as an example of an up-to-date and economical gas cooking range. Among its special features is

the polished top (the " smoothtop "), which is heated by the burners when in use, allowing other vessels to become heated which are not directly placed over the gas flames.

" Victor " Gas Heated Boilers.

A general display of hot water apparatus embodying " Victor " gas boilers, coke boilers, and various forms of combined equipment, is made by Mr. Thomas Potterton, of Cavendish Works, Balham, London, S.W., demonstrating the latest designs of plant for hot water service and heating equipment in buildings of all types. Four complete examples are shown in action to display the high efficiency obtained in water heating by gas for domestic supply and warming. These clearly indicate that properly applied gas apparatus is the most convenient and reliable fuel available. The " Victor Combination " boiler for solid and gaseous fuel, which is now well known, is fitted in conjunction with the " Brentford " cooker, illustrating a suitable equipment for the kitchen of an ordinary villa residence, flat, or cottage. The gas boiler section of the plant is in operation, and supplies hot water to the sink and bathroom. Upon this occasion the stand has a modern bathroom forming one section of the exhibit, equipped with an enclosed bath, pedestal handbasin, and nickel-plated towel dryer, all in action; while a shower is fitted and displays the regular effect obtainable with a gas heated system.

On the heating side, a system of low-pressure hot water circulation is operated from a " D " series " Victor " boiler No. 19, working four " Classic " radiators of the latest type. It is controlled automatically by an air thermostat—a speciality of Thomas Potterton—and demonstrates the great utility of gas in maintaining a satisfactory temperature in living rooms as well as for various manufacturing purposes. This example should be of interest to gas engineers and the general public, as a suggestion for treatment of houses, offices, conservatories, &c., where cleanliness and regularity of action are special considerations.

Not in action is a general display of " H " and " D " series " Victor " boilers and complete apparatus with single and twin boiler units, having proportionate storages. These provide examples of the kind of installation required for larger houses or other buildings where several baths may be installed. A useful alternative type of combined apparatus is shown in the form of a Potterton No. 921 " Victor " complete apparatus fitted in conjunction with a " Domestikatum " boiler; the latter being particularly desirable in affording the necessary warmth in winter for the domestic offices, and serving for a certain amount of cooking. Other examples of " H " series boilers are being shown to prove their simplicity and general convenience for cleaning *in situ*, which has an important bearing upon the question of maintenance. Like all " Victor " boilers, they are of sectional construction, by which efficient control of the products of combustion is obtained, together with the ratio of heating surface essential to the production of the requisite circulating temperature.

There are also examples of the self-contained portable sets, Nos. 51 and 53, adopted on the London County Council and other housing estates; while copper apparatus for use in soft water districts, applied to boiler units with rustless castings, is also prominently displayed. On the coke side, in addition to the " Victor Combination " boiler, sundry forms of wrought and cast iron boilers are exhibited for larger installations requiring treatment by this means.

A word must be said for the excellent lighting of this stand, which has been carried out by the South Metropolitan Gas Company, by means of four semi-indirect fittings and several attractive wall brackets, all switch controlled. The result is to prove that such a scheme of illumination is eminently suited to a purpose of this kind.

Geysers.

A large stand is occupied by Messrs. Ewart & Son, Ltd., of Nos. 346 to 350, Euston Road, London, N.W., who show their popular geysers of all sizes in operation for various purposes. They are seen providing hot water supplies to bath, lavatory basin, kitchen, sink, &c. Attention is particularly drawn to the full range of " B " pattern " Califonts," from the smallest, with a heating capacity of 1½ gallons per minute, to the largest stock size, heating 16 gallons per minute. " Victor " geysers are there, as is also the improved " Boilo " gas heated copper.

Boyle's Patent Water Heaters, Ltd., of No. 17, Lisle Street, Leicester Square, London, W.C., display portable water heaters which can be connected to any tap, for providing an immediate and continuous supply of hot water. Single and double models are designed to work on special gas rings. In most cases, it is stated, the heaters can be connected to the ordinary bathroom lighting supply. The double models, the makers add, will provide a good hot bath in ten to fifteen minutes.

" Ajax " geysers are shown by the Elsan Manufacturing Company, of Nos. 34 and 35, High Holborn, London, W.C. One claim made for these is that they are absolutely safe. They are so constructed that the products of combustion cannot come in contact with the water; and a temporary cessation of the water flow cannot result in damage. So simple is the construction that these geysers can be entirely taken to pieces and re-assembled in the space of five minutes. For hard water districts " Ajax " geysers are particularly recommended, owing to their special construction and character.

Barralet's geysers, which are marketed by New Geysers, Ltd., of No. 200, City Road, London, E.C., are of various patterns, and arranged for use with gas or other fuels. The " Two-Way " is intended to be fitted in the scullery, from which point it will supply water to the sink or bath at will. The " Reliafont " may also be fitted in the scullery, or any other convenient position, from which it will provide hot water to taps throughout the building. The opening or closing of any tap causes the automatic valve to operate and correspondingly open or shut the gas supply. The " Reliance " geyser automatically cuts-off the gas if the water stops running from any cause—whether through the turning of the tap, the supply failing at the main, the cistern emptying, or water being drawn at a lower tap on the same pipe.

The Collard Engineering Company, Ltd., of Palace House, Shaftesbury Avenue, London, W., show a geyser having a gas consumption of 1½ c.ft. per minute and an output of hot water of 1½ gallons per minute. The " Pollard " portable safety geyser has been designed with a view to economy and saving of labour; the intention being that it should be connected by rubber tubing to existing gas and water supplies. There is nothing complicated to get out of order, and no damage results should the gas inadvertently be lit before the water is turned on. The interior can be removed, cleaned, and replaced in a few minutes.

" Clarkhill " Water Heater.

The " Clarkhill " automatic heater " Universal Model " has been designed to work from a house cistern supply; only a small head being required. Messrs. Clarkhills, Ltd., of No. 27, Old Bond Street, London, W., state that the " Clarkhill " is an automatic, fool proof, instantaneous water heater, specially designed to supply an unlimited quantity of really hot water to as many taps as required all over the building. It can be fixed in any convenient part of the premises. Apart from its low gas consumption, it is very economical because the burners are only ignited when a water tap is opened. Simultaneously with the closing of the tap, the gas is extinguished, leaving only a small by-pass alight. The consumption of gas is proportionate to the amount of hot water required. The " High-Pressure Model " is designed, primarily, to work direct from the main, and will therefore deliver hot water all over the house at the same pressure as the main supply. This model will, however, work from a cistern providing there is at least a 12-ft. head of water.

(To be concluded.)

Dry Sterilizing of Bedding.

Sometimes planning is found to be far easier than executing, and for a time nothing was done in the way of enforcing the following regulations governing the sterilization of mattress, &c., materials which were adopted in 1923 by the California State Board of Health: " Secondhand material, waste, shoddy, or other materials named in the Act, shall be considered properly disinfected if immersed in water, maintained at a temperature of 212° Fahr. for at least ten minutes with proper arrangement for agitation of material while in the vat, and if, after disintegration the material will pass through a hole 1½ in. in diameter. Mattresses shall be considered properly disinfected when subjected to a temperature of not less than 230° Fahr. for a period of not less than 30 minutes." However, Mr. Thomas Teefer, of the Pacific Gas and Electric Company, says in the " American Gas Association Monthly " that the initiative was finally taken by a San Francisco business man, who put-in a central sterilizing plant, which is worked on a commercial basis, and the business of which is limited almost entirely to fulfilling the regulations regarding mattresses and pillows. It was necessary to have an oven to give an even heat throughout, and a special form of construction was adopted giving a 3-in. wall of insulating material. Surface combustion low-pressure equipment was used for firing, with air at 1 lb. from a positive pressure blower. The air from the oven is drawn into a fan blower, and blown through a pipe down into the combustion chamber. A single burner is used, which fires through a tunnel directly into the combustion chamber, and also into the path of the re-circulating air from the oven. The heated air is blown from the combustion chamber into a pipe which has 2-in. perforations graduated to give a good distribution of heat. This pipe is on saddles in a recess 2 ft. deep in the bottom of the oven. In this manner the heat travels directly up through the articles being sterilized without a " spot heat " (which would damage the material) at any point, and the air again travels round to enter through the combustion chamber. The re-circulation blower is of a capacity to change completely the air in the room twice a minute. With thermostatic control, there is an oven that requires no attention after lighting, and maintains the correct conditions for sterilizing. The capacity of the oven is 170 mattresses a day of eight hours. The amount of gas per mattress is 15 c.ft., and the motors add 0·2 KW. to this figure.

"B.C.G.A." DISTRICT CONFERENCES.

The British Commercial Gas Association announce a Midlands District Conference, to be held in the County Rooms, Hotel Street, Leicester, on Thursday, March 19, under the presidency of Councillor George E. Hilton, J.P. (Chairman of the City of Leicester Gas Department). After a welcome by the Mayor of Leicester (Councillor Herbert Simpson, J.P.) and an opening address by the President, Mr. F. W. Goodenough (Executive Chairman) will make a statement respecting the work and policy of the Association now and in the future; and the discussion on this will be opened by Mr. J. H. Ellis (President of the Association). Luncheon in the Oriental Hall will be followed by an afternoon session at which the following subjects will be discussed: "Atmospheric Pollution in Relation to Health," by Mr. R. Veitch Clark, M.A., M.B., Medical Officer of Health to the City of Manchester; and "The Contribution of the Gas Industry towards Reducing Atmospheric Pollution," by Mr. James Paterson, M.A. In the evening, at a reception in the Oriental Hall by the City of Leicester Gas Committee, Dr. C. W. Saleeby, F.R.S. (Edin.), will lecture on "Light and Life."

Further spring conferences have been arranged by the Association as follows:

Scotland.—Greenock, Tuesday, March 24.

North Wales and Cheshire.—Chester, Wednesday, April 29.

South-Western.—Minehead, Friday, May 8.

Manchester—West Riding of Yorks Section.—Harrogate, Thursday, May 21.

COKE FOR DOMESTIC PURPOSES.

Two special meetings of the Southern Association of Gas Engineers and Managers (Eastern District) were held at the Skating Rink, Tonbridge, on Tuesday, March 3. They took the form of lecture-demonstrations of the use of coke for domestic purposes, and were arranged at 3 o'clock and 6.30 o'clock, in order to give opportunity for as many as possible to attend. The meetings were attended by representatives of the large London Gas Companies, and by representatives of works as widely separated as Portsmouth and Leamington. The Chairman in the afternoon was Mr. A. H. Neve, Chairman of the Tonbridge Gas Company, and in the evening, Mr. H. A. Beeching, Chairman of the Tunbridge Wells Gas Company.

The demonstration of the use of coke for domestic purposes was of a practical nature, and showed the burning of suitably sized and suitably dried gas-works coke in two ordinary modern semi-well grate fireplaces. Coke was also shown burning in an ordinary anthracite stove, and in a "Glow Worm" boiler for water heating. The fires were all satisfactory, and were a surprise even to many of those connected with the gas industry. The installation of the fireplaces, &c., was arranged by Mr. J. Donaldson, Engineer to the Tonbridge Company.

There were models of various types of carbonizing plant; and a series of exhibits of coke graded to suitable sizes for different uses.

Dr. E. W. Smith, F.I.C., M.I.Chem.E., Technical Director of the Woodall-Duckham Companies, gave two lectures on the use of prepared coke as a domestic fuel. At the outset of his paper, Dr. Smith raised the question as to why one should be concerned in the finding of substitutes for coal for domestic purposes, and claimed that the reasons were because of the evils of smoke and the waste of our coal supplies. The smoke nuisance, said the lecturer, is much greater than is generaliy imagined. Over 70 p.ct. of the smoke comes from the domestic grate. Figures show that, if Manchester were as free from smoke as Harrogate, £250,000 per annum would be saved in laundering alone. In Pittsburg it has been shown that the damage is equal to £4 per head of population, or over £1,000,000 per annum. The effect of smoke on health is more serious, owing to the breathing of soot, acids, and tar, and to diminished sunlight. Sunlight is better for health than all the medicines and germicides. Smoke consists of soot, tar, and acids. Industrial smoke is less harmful than domestic smoke. In industrial processes only about 0·5 p.ct. of the fuel is lost in the form of smoke, while in domestic use about 6 p.ct. is lost. As 38 million tons of coal are used domestically per annum, it follows that over 2¼ million tons of dirt, and nearly 1½ million tons of sulphuric acid are poured into the atmosphere each year. The efficiency of the domestic coal fire is low, not being more than about 20 p.ct. On the above ground, therefore, of lack of efficiency and damage to health, justification is given for a campaign in favour of alternatives to coal for domestic heating. The requirements of heat for household use come under two main headings—warming and cooking. From the point of view of conservation of the Nation's supply of coal, electricity is inefficient and too expensive. At the present day, for every 100 tons of coal used at the electric power station, not more than 11 tons are usefully employed by the consumers. Gas is more efficient and more reasonable in price.

The gas industry effectively uses coal; and it may be claimed that it has an efficiency of between 80 and 90 p.ct. The total amount of coal carbonized at gas-works is about 16½ million tons per annum, and the coke for sale is about 9 million tons. Therefore, the coke available for use is not more than a quarter of the normal supply of coal for domestic purposes, and the whole of the coke made could readily be disposed of for such purposes with the complete elimination of stocks. Coke has been regarded too much as an inconvenient bye-product, but actually it is the most valuable credit in the whole process of gas manufacture. At present it is used too little domestically, with the consequence that its market value fluctuates with industry. If, however, coke were to be used on the domestic market for heating and cooking, the demand would be almost constant, and consequently the price.

There is an increasing demand for solid, free-burning domestic fuels; such processes as those associated with Coalite, Maclaurin, Illingworth, Sutcliffe, Nielson, &c., having received attention. It is not sufficiently realized that suitably sized and suitably dried gas-works coke is an excellent low-priced fuel. There is little doubt that, from a national point of view, none of the patent fuels can be produced at a price which will be favourable to the consumer while at the same time giving a satisfactory return to those working the process. Much work has recently been done on solid fuels and on the preparation of coke suitable for domestic purposes. The requirements are that the fuel shall be smokeless, clean to use, and easy to ignite. The subject can be treated at some length; but, put in a few words, it may be stated that coke made by any process, suitably graded and low in moisture and ash, will burn in all modern grates without difficulty. The best gradings of coke for various purposes require careful examination; and certain processes undoubtedly produce a fuel more suitable for domestic use than do others. Whatever process of retorting be employed, however, gas-works coke can be made a satisfactory domestic fuel if the above points are observed. At the conclusion of Dr. Smith's lectures, which were attended by approximately two hundred people, interesting discussions took place.

INTERNATIONAL COMMISSION ON ILLUMINATION.

(*Continued from p.* 539.)

International Agreement and Standardization.

"The Field for International Agreement and Standardization in Illumination" was treated in a paper by Mr. H. Buckley, B.Sc., Secretary to the British National Committee. The author remarked that one of the most striking characteristics of recent years has been the very marked extension of interest in the problems of illumination; and the time therefore seems particularly appropriate at this, the second, technical meeting of the International Commission on Illumination, to consider what part the Commission can take in assisting progress in illumination matters by judicious and well-considered international agreement and standardization.

Types of standardization in the following fields were considered: (1) Of international agreement on the fundamental basis of illumination; (2) of standardization of illumination materials; and (3) of international agreement on illumination legislation. As to the first, the important possibility of realizing such a standard as the candle-power of 1 sq. cm. of a black body at the melting-point of platinum was mentioned. The author stated that the problems presented by the study of candle-power standards, flicker photometry, average visibility, and energy distribution must be solved before any further progress in photometry is possible—particularly as modern developments on high-temperature radiations and spectral radiations seem likely to accentuate to a very great extent the existing difficulties.

Nomenclature, definitions, and symbols offer another field for agreement. The Commission would also be performing a very useful function if they could define, either in spectrophotometric terms or colour terms, what is meant by daylight; and, further, if the different standards of daylight which are suitable for various purposes were clearly defined.

The measurement of the absolute transmission and reflection ratios of diffusing materials requires carrying out with a view to international agreement. The use of diffusing materials—as lamp bowls and as coverings for walls—brings the problem to the notice of the illuminating engineer. The Ulbricht sphere has been used to determine these characteristics, with the surprising result that the reflection ratio of magnesium carbonate has been found to be about 98 p.ct., and not 88 p.ct., as had been previously assumed.

With respect to the standardization of illuminating materials, electric lamps have hitherto been the subject of specification in most countries, at any rate as far as concerns the vacuum lamp. The standardization of gasfilled lamps has not yet progressed equally. In this field, it is scarcely possible to expect any international specification; but it would be of

great advantage if a universal method of rating lamps could be agreed — *e.g.*, in mean spherical candle-power or lumens.

The glassware used in shades and reflectors requires standardization or specification in various directions. As to dimensions, there are numerous types of glass fittings made in which the dimensions, particularly of the rim where attachment to a metal fitting occurs, differ from type to type by amounts which seem perfectly arbitrary. The large diversity of such glassware is due partly to the possibility, before the war, of obtaining it cheaply from foreign countries in which low-paid labour was employed. The cutting-off of supplies during the war led to considerable difficulty, and glassware became increasingly made in Great Britain, France, and America; so that manufacturers obtained more control of dimensions. The production of coloured glass was touched upon. As transport becomes more and more rapid, the question of the production of coloured lights and glasses to given specifications assumes an increasing importance.

Mr. Buckley concluded his paper with some remarks on international agreement on lighting legislation. The success of the Illuminating Engineering Society of New York in the practical adoption of their Industrial Lighting Code by several States is a good omen of what conscientious work under the auspices of the Commission might achieve. Lighting legislation is, or will be, mainly concerned with factory and school lighting, street lighting, automobile headlights, &c. The work of standardization should proceed slowly, and with deliberation; for it should be remembered that premature standardization or agreement may be attended with disastrous results in preventing progress. Nor should there be over-standardization to the exclusion of industrial requirements and expression. True standardization and agreement mean merely improving and bringing into harmony that which requires improvement or which need not exhibit discordance.

Discussion.

Mr. Paterson and Mr. Walsh appreciated the importance of the subject brought forward. The latter called particular attention to three points: (1) That with the increasing use of artificial daylight some agreement should be arrived at as to the spectral distribution required for that light; (2) much valuable work could be done by an exchange of standard surfaces between the national standardization laboratories, for the measurement of diffusion, reflection, and transmission ratios; and (3) the importance of physiological factors in dealing with illumination.

M. Vautier, with regard to the last point, thought the laboratory directed by Dr. Hyde had made experiments, and said it would be of interest if Dr. Hyde would state the results of them.

Dr. Hyde replied that he regretted it was impossible to give definite and final results. The physiological and psychological questions involved were many, and of the first importance; but there had not been time enough to reach final conclusions. The only research which had been carried on in ophthalmology was on the pathology of the eye. Nothing had been done in regard to methods of preventing any disease, whether by light or other causes. As far as the United States were concerned, all considerations of factory and school lighting endeavoured to keep in view the physiological aspect.

Chemical Engineering and Chemical Catalogue.

In this book, which has been published by W. Leonard Hill, of 173, Fleet Street, E.C. 4, an attempt—and, we may say, a successful attempt—has been made to collate sales information which will be of real practical value to the vast and growing community of users of chemicals and chemical plant. The publication is a compilation, in a condensed form, of the catalogues of manufacturers, edited and arranged in such a way as to give as much detail as possible to those seeking for information on sources of supply, the possibilities of improvement in product, increase in production, and lowering in cost, by the adoption of improved and scientific methods, the latest plant, and the appropriate chemicals. The Chemical Engineering and Chemical Catalogue is designed to become a standard book of reference for consulting chemical engineers, works managers, and others charged with the specification and purchase of plant. The Committee responsible for the work have excluded such purely advertising factors as artistic display and comparative claims of quality, and have exerted every effort to furnish precise data. The volume is published at 21s.

North of England Gas Managers' Association.—The Hon. Secretary of the Association (Mr. Norman S. Cox) makes the preliminary announcement that the annual meeting will be held at Newcastle-upon-Tyne on Friday, May 1, under the presidency of Mr. S. Shadbolt, of South Bank.

"Farm Notes."—The spring number of "Farm Notes on Profitable Farming," issued by the British Sulphate of Ammonia Federation, of Nos. 28 to 30, Grosvenor Gardens, London, S.W., is filled with information of value to the practical man, and is rendered additionally interesting by the inclusion of various photographic illustrations. This publication is issued four times a year, and 25,000 copies of each issue are distributed free to farmers, merchants, and others connected with agriculture.

LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

The Monthly Business Meeting of the Association was held on Friday, Feb. 27, at the Westminster Technical Institute, Vincent Square, S.W., when there was a good turn-out of members to enjoy a lecture, illustrated by a large number of first-rate lantern slides, on a subject of great importance to those engaged on gas-works.

The President (Mr. W. Newton Booth, of Woolwich Arsenal), who occupied the chair, at the outset of the proceedings made feeling reference to the death of Mr. A. F. Browne, a steadfast friend of the Association, and one of its patrons.

As a mark of respect, the members stood silently for a short space in their places.

The President, coming to the business of the meeting, remarked that gas manufacture was becoming a more and more scientific process, and therefore the need got greater as time went on for instruments of extreme accuracy, such as were about to be described by Mr. Randall, of the Cambridge Instrument Company, Ltd., in the paper which he would now ask him to read.

THE APPLICATION OF SCIENTIFIC INSTRUMENTS TO GAS MANUFACTURE.

By H. A. Randall.

[Extracted.]

Gas engineers are realizing more every day that the installation of scientific instruments is a good investment, as it enables them to keep that close watch on the various processes employed in gas manufacture which is so necessary to ensure efficiency and economy.

Expansion Thermometers.

The instrument which has been generally adopted is the mercury-in-steel thermometer. This instrument consists of a steel bulb exposed to the temperature to be determined, and connected by means of a steel capillary tube to a form of Bourdon gauge tube. The whole system is filled with mercury. Changes in the temperature of the bulb give rise to corresponding changes of pressure in the system and, consequently, to small movements of the Bourdon spiral. A pointer which moves over a dial is operated from the spiral through suitable gearing. The capillary tube may be made any length up to 50 ft. These thermometers have a range from 40° to 540° C., and are usually calibrated to cover the working range of the apparatus on which they are installed. When it is thought desirable to know the maximum temperature reached over a certain period, a maximum pointer is provided which cannot be reset except by the person who has the key of the instrument. Alarm attachments arranged to ring a bell at any predetermined temperature can also be fitted. When this instrument is used as a recorder, two temperatures can be recorded on one chart. This arrangement is useful for recording the inlet and outlet temperatures of condensers, purifiers, &c.

The vapour-pressure thermometer is dependent on the change in pressure of a vapour with change in temperature. The range is from 30° to 400° Fahr. Though not so robust as the mercury-in-steel thermometer, it is very useful and much cheaper.

The thermo-electric pyrometer depends for its action upon the forces set up when one junction of two dissimilar metals forming an electric circuit is maintained at a higher temperature than the other.

A complete outfit for industrial purposes consists of:

A thermo-couple.

A galvanometer (either in the form of an indicator or recorder) and the necessary compensating leads.

If greater accuracy is required, it is necessary to add some form of cold junction control. The magnitude of the E.M.F. set up in the circuit depends upon the difference in temperature of the hot and cold junctions of the thermo-couple. A suitable galvanometer introduced into the circuit will therefore give a means of measuring the temperature of the hot junction, provided the cold junction temperature is known.

After dealing with the thermo-electric pyrometer, the lecturer went on to consider

Electrical Distance Thermometers.

For centralizing the temperatures of the various apparatus between the foul main and station meters, the best means to employ is the electrical distance thermometer. This method covers a wide range—viz., from 200° C. to 540° C.—and can be extended much higher by taking special precautions. In this system the change in electrical resistance of a wire (usually of platinum) with temperature is employed as a basis of measurement. The coil of wire forming the thermometer "bulb" is made to form one arm of a Wheatstone bridge, the other three arms being made of a material which does not change its resistance with temperature. As is well known, the resistances of the four coils forming the bridge can be so proportioned that no current will flow through the galvanometer forming the temperature indicator. The coils are so chosen that the above condition is fulfilled at the commencing temperature of the range of the instrument. Any change in

the resistance of the coil forming the thermometer will cause a corresponding current to flow through the galvanometer, and so deflect the pointer over the scale, which is calibrated in degrees of temperature.

The thermometers are made up in various patterns suitable for taking air temperatures, or for positions in pipes, purifiers, condensers, &c. A number of thermometers can be connected to one indicator, so that the temperature of apparatus scattered about a large works can be read from one point. By means of balancing coils, all the leads are brought up to the same resistance, so that the effect of their different lengths is eliminated. If the range of temperatures to be covered is large, the instrument can be fitted with a double scale; the change from one range to another being effected by means of a switch. When required, recorders may be used in connection with these resistance thermometers; the thread recorder being used.

The type of indicator usually met with in gas-works is deflectional. When great accuracy is required, the potentiometric method must be used.

Optical and Radiation Pyrometers.

Both thermo-electric pyrometers and resistance thermometers have a distinct upper limit of temperature beyond which they should not be used. This is because it is impossible at present to construct sheaths and wires which will withstand the destructive action of long exposure to high temperatures. Therefore, when measuring the high temperatures of gas retort settings, some form of instrument must be used which does not come into direct contact with the hot body.

An instrument which is becoming very popular in gas-works is the disappearing filament type. This is due to its robust construction, accuracy, and portability. In this instrument an image of the hot body whose temperature it is required to measure is formed by a lens on the plane of the filament of a small electric lamp. This image and filament are viewed through a second lens. By adjusting the current passing through the lamp, the tip of the filament can be brought to the same brightness as the hot body, when it merges into the background, and cannot be distinguished. If the current is not sufficient, the filament appears as a black line on a bright background; but if too much current is flowing, the filament shows up as a bright line on a darker background. The milliammeter included in the circuit is calibrated in degrees of temperature. The range is from 700° C. upwards. For gas-works, the usual range is 900° to 1600° C.

The Cambridge optical pyrometer may be regarded as a photometer in which a beam of selected monochromatic light from the hot body is compared with a beam of similar light from an electric lamp.

Light from the hot body enters the instrument through one aperture, while through a second enters light from the electric lamp. These two beams pass through an optical system whereby they are polarized in different planes, and rendered monochromatic. They next pass through a nicol prism into the eyepiece. The observer sees a circular field divided in half, illuminated by the rays from the hot body and the lamp respectively. The two halves of the field are adjusted to equal brightness by rotating the nicol prism. The range is from 700° to 4000° C.

The Féry radiation pyrometer employs all the radiation received from the hot body. This is intercepted by the concave mirror of a reflecting telescope, and brought to a focus on a small thermo-couple. The E.M.F. produced by the heating of this couple is measured by a galvanometer. Unlike the disappearing filament and optical pyrometers, this instrument can be used in connection with a thread recorder.

Automatic Temperature Control Apparatus.

Very little use has been made of the many types of automatic temperature control apparatus in gas-works. In the Cambridge temperature regulator for steam-heated tanks, a valve on the steam supply is fitted with a diaphragm chamber, and is so arranged that, when water or air pressure is applied to the back of the diaphragm, the steam is cut off. A bi-metallic thermostat located in the tank controls the pressure applied to the diaphragm, thus opening or closing the steam valve as required. Under favourable conditions it is possible to maintain the temperature of a tank within ± 1° C. by this method.

For the control of gas-fired furnaces, the apparatus designed by Mr. W. H. Apthorpe has been used with great success. With this apparatus it is possible to control any temperature from the lowest which can be measured by a resistance thermometer to the highest which can be measured by a Féry pyrometer.

Dial Gauges.

Instrument makers have for many years been producing "dry" pressure gauges which are both sensitive and robust. Some of these employ aneroid chambers. The Cambridge dial gauge consists of a leather diaphragm stretched across a metal chamber. One side of the diaphragm is exposed to the atmosphere, and the other to the pressure or vacuum to be measured. The movement of the diaphragm due to changes in the pressure inside the chamber is magnified and transmitted to a pointer moving over a scale. The scale length is 12 in. and can be calibrated for pressure or vacuum over any total range between 2 in. and 20 in. of water. If required, the instruments can be arranged with a central zero. A differential gauge is also made to indicate the pressure drop across two points, such as the inlet and outlet of purifiers or across the firebars of a boiler furnace.

Pressure and Vacuum Recorders.

Pressure and vacuum recorders working on the hydrostatic principle are too well known in gas-works to need very much description. They are sensitive and yet simple and robust in construction. The charts are usually 4 in. wide, and the range can be from 0·2 to 0·60 in. of water. In the smaller ranges no magnifying gear is employed; the magnification being obtained by suitably proportioning the ratio of the bell and float. In the higher ranges, mercury is used in the float chamber instead of water, and magnifying levers are introduced between the float and the pen arms. The zero can be arranged in the centre of the chart for use on regenerative coke ovens. These recorders are of great use on power plants using hand firing, as a record is given of when the firing took place, when the fires were banked, &c.

Recording Pressure Gauges for High Pressures.

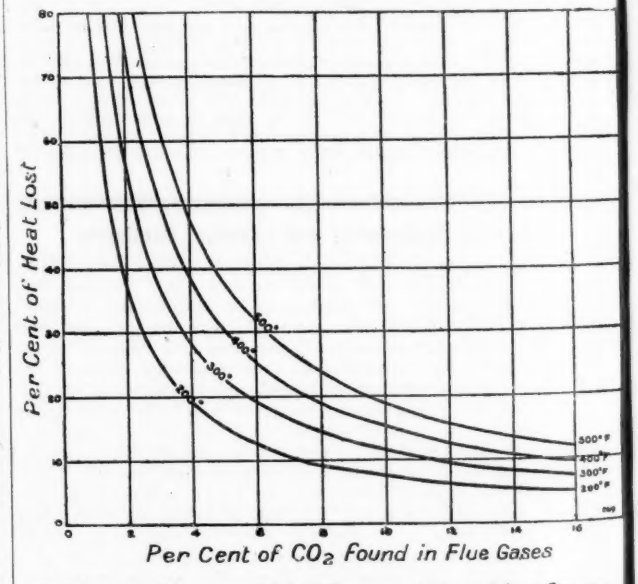
For higher pressures of gas, steam, or water, a recording gauge of the Bourdon type should be used. The charts are 9½ in. in diameter and revolve once in 24 hours or 7 days, as preferred. These instruments are made in various ranges from 5 lbs. to 1000 lbs. per sq. in. across the chart.

The ordinary method of indicating the depth of liquid in a tank by means of a float and pulley leaves much to be desired. One of the above pressure recorders, when used in connection with a special pressure box to which it is connected by a capillary tube, makes a convenient means of recording the level of liquids.

The Cambridge recording counter has been designed to record the time of each tip of one or more automatic weighing machines, and so serves to check the regularity of working. It can be used on the machines which weigh the coal, or to register the emptying of coal hoppers. As a time record is made of each tip, the instrument is more valuable than one which merely counts the number of tips. In external appearance the instrument is somewhat similar to the pressure recorders, except that the two terminals on the case enable electrical connection to be made to a contact maker mounted on the machine. As each tip is made, the instrument pen makes a short record on the clock-driven chart.

CO_2 Indicators and Recorders.

The intelligent use of CO_2 indicators in connection with temperature measuring instruments will often save from 10 to 15 p.ct. of the fuel burnt in a plant. The chart shows that



the ideal conditions are high CO_2 percentage and low flue-gas temperature. Once having established these conditions, reliable draught gauges or recorders will enable the stoker to maintain them. The particular type of CO_2 indicator and recorder to be described is a radical departure from the ordinary instrument. It is particularly suitable for the severe conditions of the boiler house, because no delicate glassware is used in its construction. Other interesting features are the electrical method employed, which permits a number of points to be connected to the indicator or recorder, and the small time lag of the apparatus, which is independent of the distance between the indicator and the point where the gas sample is withdrawn from the flue.

The instrument depends upon the variation of the thermal conductivity of the flue gas with its composition. Two identical platinum spirals are enclosed in two separate cells in a metal block; each being connected to form one arm of a Wheatstone bridge circuit. The other arm of the bridge is of manganin. The current from an accumulator flows through the bridge

and heats up the two platinum spirals. These lose heat to the walls of the cells, but the rate of this heat loss depends on the thermal conductivity of the gas contained in the cells. If the two cells contain gases of different thermal conductivities, the spirals cool at different rates, and one spiral is maintained at a higher temperature than the other. The difference in temperature causes a deflection of the galvanometer, the extent of which depends upon the difference in conductivity of the two gases. If, therefore, one cell contains a pure gas and the other cell the same gas with some other constituent, the extent of one deflection will be an indication of the second gas present, and the galvanometer can be calibrated to show directly the percentage composition of the mixture. The difference in thermal conductivity between air and CO_2 enables the method to be employed to determine the percentage of CO_2 in flue gases. Flue gases consists chiefly of nitrogen and carbon dioxide mixed with small amounts of oxygen, water vapour, hydrogen, methane, and carbon monoxide. Since carbon monoxide, oxygen, and nitrogen have nearly the same thermal conductivity, the small variations of these gases do not affect the readings. The residual of hydrogen and methane is extremely small, and the water vapour can be counteracted by keeping the gas in both cells saturated. The gases are withdrawn from the flues through a soot filter by means of an aspirator. The CO_2 meter containing the spirals is connected to the galvanometer by a four-way lead. In some cases it is desirable to have a recorder in the engineer's office, and indicators in the boiler house for the stokers' guidance. By using a multi-point thread recorder and suitable thermo-couples or resistance thermometers, combined records of CO_2 and flue gas temperature can be obtained on the same chart. This is a most useful combination, as the two records have to be read in connection with each other.

STATION METERS.

Gas measurement has always presented difficulties because of the variations in physical conditions under which it must be measured, such as pressure, temperature, specific gravity, humidity, composition, &c. When the measurement is made by an ordinary wet meter, corrections have to be applied. If the measurements are made on the basis of travel through an opening, corrections must again be used. In the Thomas meter, which is so largely used in the United States and is coming into use in this country, the basis of measurement is the specific heat of the gas, which is the most constant property of the constituent gases in town gas. The outstanding feature of the meter is that results are given directly in cubic feet at standard temperature and pressure without any correction being applied. The meter, besides integrating the total volume of gas passed, and indicating the flow, also gives a graphic record. This record is most valuable, as by its use comparisons can be made of different parts of each 24 hours, or of different days or months. The Thomas meter measures gas by raising its temperature 2° Fahr. by an electric heater, and measuring the quantity of energy required for this.

The design of the temperature difference coil is such that it automatically compensates for varying amounts of water vapour in the gas. The housing of the meter which contains the heater and thermometer is made of cast iron and is inserted in the main. The regulator and instrument panel can be located any reasonable distance from the housing. It is the usual practice to place the housing in the open, and the instrument panel in the superintendent's office. The instrument will give accurate results even under comparatively violent pulsations. As it is not dependent upon calibrated areas, it is not affected by deposits or corrosions. With this meter, when used in connection with the calorimeter to be described, a reading is given in therms, regardless of variations in the calorific value of the gas.

RECORDING CALORIMETER.

The Thomas calorimeter requires no arbitrary setting from other calorimeter readings. Ready means are provided for checking its accuracy. Once the instrument has been properly set up it will maintain its calibration over long periods. The heating value of the test gas is determined by imparting all the heat obtained from its combustion to a stream of air, and measuring the rise in temperature of this air due to the heat absorbed. The temperature rise produced in the heat-absorbing air is directly proportional to the heating value of the test gas without regard to the actual rate of burning. The rise is translated into B.Th.U. per standard c.ft., and is recorded graphically. The use of air as the heat-absorbing medium eliminates the necessity for making corrections for variations in room temperature and pressure, since air and gas follow the same physical laws as to behaviour with varying temperature and pressure.

The calorimeter is in two parts, the tank unit or calorimeter proper, and the recorder. The calorimeter consists of three water-sealed displacement pumps, geared together and power driven. One pump supplies the test gas to a burner, another the stream of cooling air to absorb the heat given up by the burner, and the third supplies the combustion air. These three pumps are arranged in a tank. The water which acts as a common seal for the three pumps only requires renewal at long intervals. Electric resistance thermometers are placed in the ingoing and outgoing stream of cooling air, to determine its temperature before and after heating. These thermometers are connected in a Wheatstone bridge circuit, and give an automatic reading of the temperature rise obtained by the combustion of the test gas, and record this result on a chart. The test burner consumes ¼ c.ft. of gas per hour; but to ensure obtaining a true sample of gas, a bleeder burner is provided before the gas pump, which consumes 3 c.ft. per hour.

The three pumps are designed so that changes in the water level affect their displacement alike. Consequently the exact water level is not essential within $\frac{1}{10}$ in. The only important requirement is the proper levelling of the whole system to suit the levelling points provided. To ensure the maintenance of the water level, an auxiliary water tank is provided, and a chain pump maintains a small circulation of water over the overflow weir. From the outlets of the gas and combustion air pumps the two streams are led to a mixing chamber, and thence to the burner. After having given up their heat to the heat interchanger, the products of combustion pass out of the calorimeter. The direction of flow is counter to that of the heat absorbing air, so that the products of combustion are cooled to within 1° or 2° Fahr. of the entering heat-absorbing air. As the combustible mixture enters the burner saturated and at the temperature of the heat-absorbing air (because of the common water seal), and leaves the instrument within two degrees of the same temperature, it is evident that essentially all the heat of combustion, including the latent heat of vaporization of the water of combustion, is given up to the heat-absorbing air. In the latest type of instrument the test burner and heat interchanger are placed in a bucket-shaped casting low down in the tank. It is therefore independent of change in room temperature. The recorder is a special type of recording Wheatstone bridge, and may be placed any distance from the tank unit. If desired, one or more duplicate recorders may be worked off the same tank unit.

Discussion.

The PRESIDENT said he was sure they would all agree that Mr. Randall had given them a great deal to digest. His description of instruments had covered a very wide field indeed.

Mr. J. H. GOLDSMITH (South Suburban Gas Company) remarked that he had been very interested in the lecture, and would like to know the cost of replacement units for the disappearing filament type of pyrometer. If the lamp was apt to need replacing frequently at 1400°, it would become expensive when using it on a gas-works. He would also like to hear as to the suitability of the depth gauge described by the author for tar and liquor tanks, and whether it had been applied to this purpose.

Mr. RANDALL replied that the cost of renewal of the disappearing filament lamps would vary with each maker, but it was not a big item. As had been pointed out, the temperatures met with in the retort house were above 1400°, and this had been got over by keeping the lamp below that temperature by introducing a screen between the lamp and the hot body. In this way one did not get the temperature above the point at which one started to age the lamp considerably. There need be no fear in using the instrument for quite high temperatures in this way. For up to 2000° one screen could be provided, but the instrument had to be calibrated with that screen in position. The particular form of depth gauge to which he had referred had not been used in connection with tar tanks, and he doubted whether it would be suitable for this purpose. One would get the whole thing choking-up in the box. There was, however, at the present time another form of depth gauge being brought out, consisting of the ordinary cord, float, and pulley. This could be adapted to read depths and temperatures on the same instrument, and would work better in a tar tank than the one he had described, which had only been so far used for water, and liquids of that character.

Mr. ROBUS, speaking as a visitor, inquired whether there was an instrument for employment with a water gas generator, which would record the temperatures of the coke in the different fire zones. The fire sometimes had a tendency to creep-up the brickwork, and if it were possible to record these temperatures on a chart it would be useful.

Mr. RANDALL replied that one could use the thermo-electric instrument. Contact was all that was needed. If the end of the thermo-couple was embedded in, and flush with, the wall of the generator, it would be sufficient for a comparative temperature to be arrived at, though not perhaps a true one. But in many cases of temperature taking it was a comparative reading that was wanted more than an actual one.

Mr. D. J. WINSLOW (Lea Bridge District Gas Company) touched upon the question of reliability in two instances—one was the opening and closing of the high-pressure valve in connection with gas distribution, and the other was the gas valve in regulating the heat of a muffle furnace.

Mr. RANDALL replied that the particular form of apparatus described by him was designed because of the unreliability of most regulators. The whole trouble with regulators up to the present had been the relay. The apparatus to which he had referred in its latest form had proved quite reliable—*i.e.*, since the adoption of the differential thermo-couples. The apparatus proposed for opening and closing high-pressure gas valves had been tried in about a dozen cases on steam valves, and there it had been found quite reliable. He did not think there was any likelihood of its going wrong suddenly.

The PRESIDENT said they had had a thoroughly good evening. One thing he would have liked to discuss was the question of maintenance on the works of the various apparatus described.

Mr. W. T. KENSHOLE (Lea Bridge) proposed a hearty vote of thanks to Mr. Randall for coming there and giving his lecture, and to the Cambridge Scientific Instrument Company for permitting him to do so.

Mr. J. K. GRANT (South Suburban Gas Company) seconded the vote.

Mr. RANDALL, in reply, pointed out that the field he had

covered was so wide that he had only been able to describe the instruments of his own particular Company. This was not a matter of choice, but of necessity in the circumstances. He hoped, however, that he had said enough to arouse their interest in the subject generally.

ANNUAL DINNER AND CONCERT.

On Saturday, March 7, the Association held their twelfth annual dinner and concert in the Cambridge Room of the Great Eastern Hotel, Liverpool Street, E.C.; and the evening was enjoyed with the enthusiasm which marks all the events of this energetic organization. Mr. W. Newton Booth, the President of the Association, took the chair; and among those at his table were Mr. W. B. Leech, Engineer at the Beckton Works of the Gas Light and Coke Company; Mr. John Terrace, Chief Engineer of the South Suburban Gas Company; Mr. J. M. Campbell, Engineer and Manager of the Isle of Thanet Gas Light and Coke Company; Mr. P. E. Williams, of the Commercial Gas Company; Mr. C. M. Croft, Engineer of the Wandsworth, Wimbledon, and Epsom Gas Company; Mr. Walter Grafton, of Glasgow, to whom a presentation was made; Mr. F. Carnegie, Chief Mechanical Engineer at the Royal Arsenal; and Mr. R. C. Macdonald, Chief Mechanical Engineer of the South Metropolitan Gas Company. There were also present Mr. W. L. Westbrook (Senior Vice-President), Mr. Leonard Lacey (Hon. Secretary), Mr. W. H. Noble (Assistant Hon. Secretary), and Mr. A. Broadbent (Junior Vice-President and Hon. Treasurer). The members and their ladies came to enjoy themselves; and nothing was wanting, in the dinner itself and in the entertaining programme afterwards, to make the evening a great success.

After the honouring of the Loyal Toast, at the call of the President,

Mr. J. M. Campbell proposed "The Association," for which, he said, he had a very warm affection—the sort of feeling a father had for a son of whom he was proud. As a parent of the Association, however, he had been forced to desert the child after a year; consequently it gave him singular pleasure to see how it had developed, and how strong and powerful a body it now was. It was a veritable Hercules at 23 years of age. Its virility spoke well for the work of the Presidents and the Council, to whom all credit was due. Three years ago, in a presidential address to the Southern Association of Gas Engineers and Managers [see "Journal" for March 29, 1922, p. 757], he had spoken of the need for training juniors; and everything he then said held to-day. His remarks on that occasion were mainly directed to the necessity for seniors giving the juniors a chance. Perhaps some seniors appeared reluctant to give encouragement. However this might be, it was up to the juniors to grasp opportunity, when it presented itself, with all eagerness. The London and Southern District Junior Gas Association was one of the best in the country. Being able to draw members from works of great magnitude, it had unique opportunities of having as members men who were experts in their specialized departments. Thus the papers presented were particularly valuable; and while speaking of this, he would say how excellent was the standard of their presidential addresses. Of course, their work entailed sacrifices of time, which, on some fine Saturday afternoons, were real sacrifices. However, they realized what benefit resulted from their meetings and visits to works.

Mr. W. L. Westbrook, responding, said that the object of the Association was to extend the technical knowledge and welfare of the members. How far they could do this depended in no small measure on the assistance of the seniors; and he would take this opportunity of expressing the thanks of the Association for the valuable help which they received. They were also indebted to many manufacturing firms. Also he would like to thank those who did the spade work in the early days of the Association's history. He hoped that these men would derive pleasure in the realization that their work had been well founded and had borne excellent fruit.

Presentation to Mr. Walter Grafton.

The President then said he had a very pleasant and, he thought, a unique duty to discharge, which was to honour one of the men whose efforts in the early days had been spent for the good of the Association. He referred to Mr. Walter Grafton. [Applause.] He (the speaker) was just old enough to remember the early days of the Junior Association. It was true that at first they were not regarded entirely without suspicion. Certainly their inception was no light task. In 1902 an idea of the formation of a Junior Association had formed in the mind of Mr. Campbell; and this culminated in a letter to the Technical Press. The suggestion was taken up by Mr. Grafton, who at that time was lecturing on gas subjects at the Regent Street Polytechnic. To him was due the growth of the Association which had since then taken place. It had been difficult work, and sympathy had not always been on Mr. Grafton's side. Mr. Grafton was an outstanding man; and he (the President) only hoped that his return to the Association had shown him that the seed which he had sown had been planted in good soil. He would ask him to accept an illuminated address similar to that given to retiring presidents.

The address bore the following inscription:

London and Southern District Gas Association.

Presented to Mr. Walter Grafton by the Officers and Members of the London and Southern District Junior Gas Association. It is their wish thus to convey to him their sincere appreciation of the pioneer work done by him in the founding of this Association, and as their First President during the years 1902-06, and to place on record their deep indebtedness to, and full recognition of, the signal services he has continued to render to the Junior Gas Associations.

(Signed) W. Newton Booth, President.
Leonard Lacey, Hon. Secretary.

Mr. Grafton, after expressing his deep appreciation of the honour, said that he was glad, on his return to the Association, to see four or five faces which were familiar to him. Among these men he would mention Mr. Liberty, whose help in the early days had been very great. He, personally, by no means took the credit for the formation of the Association. The late Mr. Quintin Hogg and Mr. Robert Mitchell, the pioneers of the Polytechnic, had rendered real service in placing at their disposal a room at that institution. To such men as Messrs. Campbell, Scarth, Liberty, Upton, and Madden, the present virility of the Association, which since its inception had never looked backwards, but had gone on from strength to strength, was due. It gave him great pleasure to see the success which many of his old students had achieved, many of whom were now engineers and managers of large gas undertakings, and some of whom were Members of Parliament. He wished the Association all good fortune.

The toast of "The Visitors" was in the hands of Mr. D. Cleave Cross, of the Lea Bridge Gas Company.

Mr. John Terrace replied. He was glad of the opportunity, he said, because it afforded an indication of the sympathetic feeling which the seniors had for the Junior Associations. In the early days, perhaps, the amount of sympathy extended was not too great; but the position was vastly different to-day. Mr. Campbell had referred to education and training. This subject was very close to his heart, and he wanted to take this opportunity of appealing to the juniors. The subject of education had not received the attention it deserved; and they, as a live industry, were in urgent need of education. In the early days the attainments of managers of gas-works were in general meagre; and until the last few years no definite attempt had been made by the gas industry itself to remedy this fault. Now, however, they had the Institution's Education Scheme—a scheme which had taken a long time to mature and had necessitated a great deal of discussion. It applied to almost every branch of the industry, and he hoped it would raise the status of those responsible for the control of gas undertakings. They needed educated men; and education was the main function of the Junior Associations. They must prepare themselves for big things, for the gas industry would in the future be a still greater factor in the comfort of the State than it was to-day. He appealed to the Association—and he felt sure his appeal would not be in vain—for their best support.

"The President" was proposed by Mr. Walter Grogono, who said that this was the first year the Association had had as President a man who was chief of a works. Mr. Newton Booth in his work met with problems which did not confront all gas engineers, and his help had been most valuable. His dealings with the Council had always been delightful, and all his work was characterized by an admirable modesty.

Mr. Newton Booth, in reply, said how pleasant his work as President was made by the support and good feeling of the Council.

The remaining toasts were "The Secretary and Treasurer," proposed by Mr. W. T. Kenshole, and replied to by Mr. Leonard Lacey and Mr. A. Broadbent; and "The Press," which was submitted by Mr. George Winslow.

Southern Association of Gas Engineers and Managers (Eastern District).—The next meeting of the Eastern District of the Association will take place next Wednesday, the 18th inst., at 2.30, at the Institution of Gas Engineers, No. 28, Grosvenor Gardens, S.W.

Scottish Junior Gas Association.—A joint visit of the eastern and western districts is to be made on Saturday to the Limewharf Chemical Works, Falkirk, of Messrs. James Ross & Co. At the end of the inspection, the firm will entertain the members at tea.

Joint Manchester and Yorkshire Junior Association Visit.—A joint visit of the Yorkshire Junior Gas Association and the Manchester and District Junior Gas Association to the Neepsend Gas-Works and Messrs. Vickers, Ltd., Sheffield, has been arranged to take place next Wednesday, the 18th inst. Members will assemble at the Sheffield Railway Stations, Midland or Victoria, at 10.15 a.m. At luncheon they will be the guests of the Directors of the Sheffield Gas Company; and at tea, of Messrs. Vickers.

YORKSHIRE JUNIOR GAS ASSOCIATION.

A meeting of the Association was held in the Library at the "Y.M.C.A.," Albion Place, Leeds, on February 21—Mr. E. GILLETT, of Bradford, presiding.

The CHAIRMAN offered the Association's congratulations to Mr. F. A. C. Pykett, of Halifax, the Hon. Secretary of the Association, on his appointment as Distribution Superintendent at Lancaster, and to Mr. J. Wilson, also of Halifax, on his appointment as Resident Engineer at Fleetwood. Mr. Pykett had been the Hon. Secretary of the Association for three years, and he thought that some fitting tribute should be paid to him for the services he had rendered. At a Council meeting it had been decided to open a subscription list for a presentation; and it was hoped that all members would participate. Mr. Gillett then announced that the position of Hon. Secretary had been considered by the Council; and they recommended the appointment of Mr. J. W. Horwill, of Bradford, to the position.

Mr. Horwill's appointment was unanimously approved.

THE VALUATION AND TESTING OF GAS COALS.

The CHAIRMAN then said how pleased they were to see Mr. Fred J. Jackson, of Sheffield, with them again. Mr. Jackson's paper was read to them at the last meeting by Mr. R. N. Webb, of Leeds. He would now call upon Mr. F. Firth, of Leeds, to open the discussion.

Mr. FIRTH said he wished to congratulate Mr. Jackson on a very useful paper. Coal testing was important to the industry; and though Mr. Jackson said it was non-productive, it was economically sound. The information, properly used, could considerably influence the financial well-being of a gas concern using it. Another aspect, probably of no less importance, was the moral effect which the knowledge that the coal test plant existed on a works played in keeping the quality of the coal deliveries up to standard. One of the main objects was to compare deliveries with samples, and when dealing with a new coal to obtain comparative values. To do this, identical conditions in procedure were essential; the only varying factor being the coal. The plant described was no doubt very suitable for this purpose. The weight of the charge adopted tended to reduce errors in sampling and measurement. It was a good plan to isolate a unit on the works, and under actual works conditions, with all its variable factors, obtain information with regard to yields, behaviour during carbonization, and other necessary data which could be usefully applied for controlling the rest of the plant when carbonizing any particular coal. Mr. Firth incidentally remarked that he would call this an experimental plant, not a coal-testing plant. The information obtained would probably be of little use to another works, even when using the same class of coal, owing to differences in carbonizing conditions and procedure. With the laboratory test, using very small quantities of coal, it was absolutely essential that a true sample be obtained. The difficulty of obtaining a representative sample formed one of the arguments against the adoption of laboratory tests. In his opinion the minimum quantity of coal used should not be less than 1 lb., to allow for sufficient gas being collected for calorific determinations. In the laboratory and the coal test-plant tests the comparison of the coals was based on the yields of gas and coke. The bye-products, tar and liquor, were treated as of secondary importance, which in his opinion was justified, as the yields of these products were materially influenced by the conditions of carbonization. Turning to Mr. Jackson's coal-test data, Mr. Firth remarked that the CO was 7 p.ct., which for carbonizing temperatures of 950° to 1000° C. would appear to be on the high side. Would Mr. Jackson explain this? Would Mr. Jackson explain how he drew a relationship between the gaseous yields and the ash content of the coke? Mr. Firth said he had worked out the following figures regarding this relationship.

Washed Peas.

No.	Ash in Coal. P.Ct.	Coke (Ash Free) P.Ct.	Gas Yield. C.Ft.	Therms Per Ton.	Coal (Ash Free). Yield Vol. Matter.	Therms ÷ Vol. Matter.
1	7·2	64·9	11,954	75·86	34 05	2·16
2	11·34	64·7	12,560	73 3	35 57	2 07
7	4 59	63 86	12,610	72 84	34 89	2·01
8	5·02	66·9	11,480	69·8	34 7	2·11
12	4·16	67·2	12,330	73 86	37 58	2·25

Screened Coal.

7	20·5	63·67	15,170	89·3	41·75	2·45
8	8·1	69·26	12,330	73·44	40·1	2 39
10	6·65	67·1	11,360	70·7	34·53	2·15

Mr. Firth proceeded by saying that the therm yield divided by the volatile matter gave a constant for a definite class of coal. He would have liked to follow this further by comparing the factor with the rate of distillation. Unfortunately the rates of carbonization were not available. He suggested that the above-calculated figures were some argument that the gas yield was not influenced to any great extent by the percentage of ash present, though the contrary would be the impression created by a survey of the tables given by Mr. Jackson. What was marked was the difference in volatile matter obtained on the same class of coals, calculated ash-free basis, assuming the volatile matter was everything in the coal except the residual coke. Mr. Firth asked Mr. Jackson what was the life of his retorts on the plant; and how the tar and liquor were recovered so that the yields could be isolated.

Mr. JACKSON said that 8 months was an average figure for the life of the cast-iron retorts; the outside limits being 7 and 10 months. He thought the isolation of a unit on the works was desirable, but presented great difficulties. In the case of a works with a 7-ton Woodall-Ducknam vertical retort plant there was a common off-take to two retorts, and it might be necessary to isolate two retorts. It would be no small business to deal with the products from 14 tons of coal per day, having due regard to the condensing, purification, storing, and testing apparatus necessary. As stated in his paper, coal testing was non-productive; and he very much doubted if it would be economically sound to have to deal experimentally with 200,000 c.ft. of gas per day. Concerning the use of apparatus dealing with 1 lb. of coal, the yield of gas from this charge would be somewhere in the region of 5 or 6 c.ft., and having in mind the necessity for "sweeping" all apparatus, Mr. Jackson felt that he would not like to condemn a coal on the results obtained in this way. The CO content (7 p.ct.) of the gas from the experimental plant was not in his opinion abnormally high. Mr. Firth had gone to some length in his comparisons on the ash-free coals. None of these figures required a close study, bearing in mind the fact that Mr. Firth had only touched on the subject by quoting figures from a few tests, and not the complete series. The series of tests were taken over a period of years; and to have included the rates of carbonization would have enlarged the subject tremendously, and placed it outside the scope of a short paper.

Mr. W. I. INESON (Bradford) inferred that Mr. Jackson was of the opinion that there was only a broad relation, if any, between thermal yield and ash content. In his own experience there was a narrow relationship between the true coal substance—*i.e.*, ash-free coal—and the therm yield. This relationship was sufficient guidance to enable an engineer to gauge his results.

Mr. C. H. CHESTER (Wakefield) agreed that a test plant was a distinct advantage to a large works, but he thought that for a small works laboratory examinations served a very useful purpose.

The CHAIRMAN said that in some respects the small works had an advantage over the bigger ones, because it would be possible to use the whole plant (say) for 24 hours on a test.

CARBON BISULPHIDE IN COAL GAS.

Some Notes on its Formation and Elimination.

By G. GRIFFITHS (Bradford).

Gas engineers have been accused, perhaps with justice, of concentrating their attention on the retort house, to the detriment of their purifying system. Certainly, concentration was, and still is, needed in the former process, but purification, and in particular the complete removal of sulphur, is beginning to attract the interest it deserves. Present-day conditions demand that gas should be sold at a competitive figure—a problem which has been met by the evolution of the modern carbonizing plant and the use of lower-grade coal. Fresh difficulties are raised by modern gas manufacture, however, not the least of which is the grave increase in the sulphur content other than hydrogen sulphide of the gas produced. Of this so-called unremovable sulphur, some 80 p.ct. consists of carbon bisulphide, together with about 15 p.ct. of thiophene, the remainder most probably being methyl and ethyl sulphides and possibly some mercaptans. It will be seen from these figures that the main portion of the sulphur is provided by carbon bisulphide; and the fact that it is the only constituent which can be removed in bulk makes it doubly important to the industry.

Carbon bisulphide in the pure state is a highly volatile and inflammable liquid, with a not unpleasant ethereal odour, its composition being roughly 84 p.ct. sulphur and 16 p.ct. carbon, the former compound making its presence in gas highly undesirable, owing to the formation of sulphur dioxide on combustion. Sulphur dioxide in appreciable quantities is a serious detriment to the use of gas, particularly in the case of lighting and all flueless apparatus, and for certain industrial purposes it may constitute a serious drag on the gas sales. If the products of the combustion of coal gas were carbon dioxide and water only, a great saving in maintenance costs would be effected (a factor of vital importance to the lighting load) and the consumer would be able to use flueless gas appliances without suffering any irritation.

The existence of sulphur other than hydrogen sulphide in coal gas was recognized in the early days of the industry, but Brande, in 1820, first suggested that it was present as carbon bisulphide, a theory which was proved by Thompson (xanthate reaction).

$$CS_2 + C_2H_5OK = KC_2H_5COS_2 \text{ (potassium xanthate).}$$

From about the year 1850 the question of sulphur other than hydrogen sulphide present in coal gas caused a tremendous amount of discussion, coming to be known as the "sulphur bugbear," and culminating in the Sulphur Restriction Acts. Undoubtedly, however, these penal laws gave a fillip to the investigation of the sulphur problem, which was carried out with partial success until Hall and Papst and Carpenter and Evans were able to operate their processes on the commercial scale.

SULPHUR IN COAL.

The carbon bisulphide question commences, of course, with the coal used; a high sulphur content being a vital factor. In the majority of cases the high cost of good gas coal and the

cost of transport render it necessary to use a local coal where possible, which may have a sulphur content of from 2 to 4 p.ct.

Sulphur is present in coal in three types of combination:

(1) Organic—combined with the coal substance.
(2) Pyritic—as iron pyrites.
(3) Fixed as sulphates of the alkalis or calcium.

The three varieties behave quite differently on carbonization. The reactions involved are open to theory; but it is suggested that the sulphur in organic combination is first decomposed, forming primary products containing carbon and hydrogen, these being decomposed by increasing heat to hydrogen sulphide. The pyrites decompose at a higher temperature with the production of ferrous sulphide and sulphur; the latter combining with hydrogen to form hydrogen sulphide, and with the carbon to produce carbon bisulphide. The sulphate sulphur, though undergoing changes, does not form volatile compounds, but remains fixed in the coke, probably as sulphide. This theory would suggest that the chief producer of carbon bisulphide is the pyritic sulphur; the organic sulphur merely producing the former compound by the decomposition of the hydrogen sulphide it forms.

Alternatively, however, it is suggested that, of the organic sulphur, some 80 p.ct. is converted to carbon bisulphide; but this must surely be over-stating the case. It will be noted that the active types of sulphur are the organic and pyritic, and they are consequently known as "volatile" sulphur. This suggests that under similar carbonizing conditions there will be a distinct relationship between the volatile sulphur of a coal and the carbon bisulphide content of the gas it produces. To illustrate this point, a number of coals of widely differing sulphur content were carbonized in our experimental station; samples of the coal being tested for volatile sulphur, and the gas made being tested by the Referees' method for sulphur other than hydrogen sulphide. The test plant, it may be stated, consists of a generator-fired setting of five single retorts working at an internal temperature of 1000° C., the draw on the retorts being about one tenth.

Volatile Sulphur Test.

This was carried out by the method recommended by the Gas Investigation Committee. About 1 gramme of finely-ground coal is weighed into a porcelain boat and transferred to a combustion tube packed for about 18 in. with pieces of porcelain. A slow stream of oxygen is passed through the tube; strong heat being applied to that part containing the porcelain. When this is at a good temperature, the coal is gently heated, and the products of combustion are completely oxidized by passing over the red-hot packing; any sulphur dioxide formed being removed by two wash-bottles containing potassium hypochlorite.

On the complete oxidation of the coal, the tube is allowed to cool and is well washed out with hot water; the washings and hypochlorite solution being tested for sulphur, which is estimated as barium sulphate.

Results of Coals Tested.

Coal No.	Volatile Sulphur. P.Ct.	Sulphur in Gas. Grains per 100 C.Ft.	Grains of Sulphur per Ton of Coal.	Sulphur Ratio Grains per Ton to P.Ct. Vol. Sulphur.
1	1·4	18·2	1979	1410
2	1·6	26·0	2914	1820
3	1·7	26·0	2696	1590
4	1·8	31·7	3383	1880
5	2·0	31·3	3362	1680
6	2·6	33·2	3515	1350
7	2·9	38·5	4040	1390
8	5·2	48·0	4751	910
9	6·2	58·0	5287	850

From the foregoing table a curious relationship will be noted between the percentage of volatile sulphur in the coal and the total weight of sulphur in the gas from one ton of coal. This ratio may possibly be varied by alterations in the organic sulphur-pyritic sulphur balance; but no test was made for pyritic sulphur, and the ash contents do not afford much help in estimating it. Assuming that organic sulphur is more productive of carbon bisulphide per unit weight, the increase may be due to a larger percentage of organic sulphur as against pyritic sulphur, and the falling-off in the latter half of the table may be due to an increase in pyritic content.

Carbonizing Conditions Affecting the Formation of Carbon Bisulphide.

1. *Temperature.*—So long ago as 1850 Lewis Thompson recognized that the carbon bisulphide content of coal gas was increased by the use of higher carbonizing temperatures. The following tables by Wright and Carpenter aptly illustrate the fact.

Gas Made per Ton of Coal, with Increasing Carbonizing Temperatures (C.Ft.)		Sulphur Content of Gas in Grains per 100 C.Ft.
Wright	6,800	13·9
,,	8,300	19·2
,,	9,400	26·7
,,	10,700	36 9
,,	11,600	44·2
Carpenter	7,913	19·6
,,	10,942	29 96
,,	13,219	53·3

This increase in sulphur content may be due to an increased evolution of sulphur from the coke, and the secondary reaction at high temperatures of hydrogen sulphide and carbon, with the formation of carbon bisulphide.

$$2\,SH_2 + C = CS_2 + 2H_2$$

2. *Steaming and Over-drawing in Vertical Retorts.*—These tests were carried out on a single retort, fed from a bunker which was charged with one grade of coal only, to avoid any variations caused by alterations in the coal supplied. A gas sample of about 0·5 c.ft. was taken over a period of half-an-hour; and after the removal of the hydrogen sulphide by washing with lead acetate solution, the gas was burnt in the Referees' apparatus, the sulphur contents being tabulated below:

Conditions in Retort.	Sulphur in Gas.
1—Level gauge, no steam	66 grains per 100 c.ft.
2—Level ,, moderate steaming	62 ,, ,, ,, ,,
3—Two-tenths draw, no steam.	65 ,, ,, ,, ,,

Apparently, moderate variations in the retort house do not greatly affect the sulphur content. Steaming reduces the amount a little, possibly acting as a diluent and having a protective action on the hydrogen sulphide, preventing any secondary reaction with the coke. So far as over-drawing is concerned, the flue-gases pulled-in appear to have entered the retort above the carbonizing zone, and could therefore exert very little effect (analyses of this gas show increases in carbon dioxide and nitrogen content).

Elimination of Carbon Bisulphide.

The prevention of its formation is, of course, impossible; but certain palliatives are successful, among which may be enumerated:

1. The use of washed coal. Screening is not very effective, but washing undoubtedly removes much pyritic sulphur.
2. The rapid exit of gas from the retort, preventing any secondary reaction of hydrogen sulphide with the coke.
3. Avoidance of excessive heats.
4. No undue prolongation of the carbonizing period. This may occur in vertical retorts, where the gas make is governed by the extractor speed.
5. Cooper's liming process. This method was patented by Cooper in 1882, who claimed much virtue for the admixture of 2 p.ct. of slaked lime with coal before carbonizing. Certainly the claim for smaller sulphur content was substantiated, but the process fell into disrepute owing to disappointment at the failure of other claims which were made for it. Paterson revived the procedure in 1911, and made the liming of the coal mechanically efficient, giving almost each piece of coal a separate dusting of lime. A reduction in sulphur content of about 50 p.ct. was claimed for this method, while no difficulty was experienced in the producers. The coke was not affected in appearance, and was readily saleable. There is no doubt that this lime acts chemically, absorbing a certain amount of volatile sulphur; but it has been suggested that catalysis may play a part, in some cases an increase in hydrogen sulphide being reported. Possibly the process does not go far enough, which may account for its lack of popularity; otherwise there seems little against it, theoretically or practically.

Carbon Bisulphide Removal.—Physical Methods.

Carbon bisulphide may be removed by:

(1) Physical methods.
(2) a. Simple chemical reactions.
b. Catalytic reactions.

It may be extracted by wash-oils or by charcoal absorption. It has been suggested that oxide containing much free sulphur will remove some proportion of it; but the amount is negligible. Absorption by wash-oil is difficult, owing to the high vapour tension of carbon bisulphide; but the process has been used experimentally in Canada with some measure of success. A wash-oil or kerosene or light lubricating oil was used, the amount being from 0·5 to 1 gallon per 1000 c.ft. A reduction in sulphur content of 50 p.ct. was claimed. In the stripping of gas for benzole, some carbon bisulphide is removed; but the amount is small—perhaps 10 p.ct. Gordon Adam has patented the use of granulated wood or animal charcoal, which shows selective absorption for sulphur compounds. The charcoal used is limited to that amount which would just be saturated with the sulphur compounds—in practice about 70 lbs. per ton of coal carbonized. The charcoal, which must be used on purified gas, may be regenerated by heating to 300° C. The objections to wash-oil processes are the low efficiency, the large amount of oil which must be used, and the cost of the plant; but the charcoal process suggests simplicity and regularity in action, though the large amount necessary is a serious drawback.

Chemical Methods.

By washing the gas with alkaline polysulphides, some carbon bisulphide is absorbed, forming a thiocarbonate; but the reaction is inefficient and uncertain.

Lime Purification.—Lime was first used by Clegg for the removal of hydrogen sulphide; but its use as an absorbent of carbon bisulphide was soon recognized, the reactions being determined by Divers and Veley. In the absence of carbon dioxide, lime forms calcium hydrosulphide, which gives with

water or oxygen the hydroxy-hydrosulphide. This latter compound will react with carbon bisulphide, forming the thiocarbonate.

$$2\,CaOHSH + CS_2 = H_2S + Ca(OH)_2CaCS_3$$

or

$$3\,CaOHSH + CS_2 + H_2O = H_2S + 2\,(Ca(OH)_2)\,CaCS_3.$$

The temperature of the box must be at least 50° Fahr.; a certain degree of revivification being possible by the admission of air. The weakness of this process lies in:

(1) The necessity for the removal of the carbon dioxide.
(2) The loss of sulphur.
(3) Constant supervision necessary.
(4) The difficulty in disposing of the spent lime.

Athion Process.—This has never gained favour here, though it has been used on the Continent. The gas, after normal purification, is washed with potassium carbonate solution, which removes the carbon dioxide forming potassium-bicarbonate—the latter compound being revivified by boiling. The carbon bisulphide is removed by alkalinated cellulose, with the formation of cellulose xanthogenate, or viscose. The efficiency claimed is 75 p.ct., using a gas containing 30 grains of sulphur per 100 c.ft.

Purification by Heat.—Carbon bisulphide in coal gas will react at a high temperature forming hydrogen sulphide and carbon. This reaction was used empirically at an early date, though Thompson, and later Bowditch, failed to make the process a commercial success; Hall and Papst, of Oregon, first using it on the practical scale.

Hall and Papst Process.—The plant consists of two reheaters filled with chequer-brickwork, being heated alternately by producer gas. The gas after normal purification is led into No. 1 reheater, during which time No. 2 is attaining working temperature. When No. 1 drops below the minimum temperature, the gas flow is reversed, No. 1 being heated and No. 2 being the reaction chamber. The efficiency claimed is 60 to 70 p.ct., and the plant is simple in design and requires little skilled supervision. The high temperature used (500° to 700° C. and upwards) may be detrimental to the gas, however, and the alternate method of working makes it necessary to change the gases in the reheaters before and after each run.

CATALYTIC REACTIONS.

To overcome the disadvantages of heat purification, catalytic agents have long been experimented with. The advantages they offer are the increase in velocity of the reaction and the lower temperature required. Successful catalysis depends on the provision of economical heating, and a catalyst unaffected by long use or poisoning (as by cyanides &c.). Thompson suggested the use of platinum, and later clay balls coated with a metallic salt or the metal itself were tried at Stockholm; but no economic working was obtained until the advent of the Carpenter-Evans process.

Carpenter-Evans Process.—Nickel-coated fireclay balls are used at a temperature of about 400° C. In practice, purified gas passes through heat interchangers to the preheaters. The temperature is here raised to 400° C., the gas then passing to the reaction tubes, which are worked at 450° C. It then returns to the heat interchangers, and so on to the oxide purifiers, where the hydrogen sulphide formed is removed. The plant, which is heated by producer gas, has an efficiency of 75 p.ct., but the catalyst becomes inactive owing to the deposition of soot, which is burnt off by the periodic admission of air. This operation requires much care to avoid excessive temperature. Given proper supervision, this process is both reliable and economical; the quality of the gas being practically unaffected.

Rideal-Taylor Reaction.—Here the carbon bisulphide reacts with steam, forming carbon dioxide and hydrogen sulphide. Coal gas, containing sufficient steam to prevent the reduction of the catalyst, is passed over iron oxide activated with a little oxide of chromium. The reaction temperature is 350° C., and the hydrogen sulphide is removed by oxide purifiers. Gas containing 7 p.ct. of steam is passed over the catalyst. The efficiency claimed is 90 p.ct.

Reviewing the many processes which have been mooted for the removal of carbon bisulphide, one cannot fail to notice the complete agreement of gas chemists on the subject—that carbon bisulphide must be removed. In the early days of the gas industry, with the use of high-grade coals and low carbonizing temperatures, much attention was given to its removal, though the reactions governing its extraction were only comprehended in part. What is the position to-day? High-temperature carbonization of coals which previously would have been rejected has increased the sulphur in gas by 300 p.ct. Inventors have provided the industry with a variety of methods to combat the evil, but their efforts have met with apathy. It was said in earlier days that these sulphur compounds were only known to the learned, inhabiting the higher regions of scientific life, but to-day the consumer is aware of them. He may call them bad gas instead of sulphur compounds, but what of that? Meanwhile the trouble goes on. Complete purification may leave much to be desired, but it is far past the experimental stage, and can be placed on an economic basis. If the gas industry is content to wait for the evolution of "a perfect system of purification," the time may have passed when it will be of benefit.

I wish to record my indebtedness to the Gas Engineer, Mr. Charles Wood, F.C.S., for his kind permission to use the figures given here, and to the Chief Chemist, Mr. W. I. Ineson, for his assistance.

Discussion.

Mr. T. G. LEWIS (Leeds) was doubtful of the secondary action between hydrogen sulphide and coke. Oil washing had the disadvantage of reducing the calorific value of the gas, but he was informed that a low-temperature process for sulphur removal was being investigated. A high efficiency was claimed for it, and it would be on the market in the near future. He thought the Referee's sulphur test uncertain. With regard to CS_2 absorption by charcoal, the CS_2 was afterwards displaced by benzole, &c.

Mr. GRIFFITHS said that the reaction between coke and hydrogen sulphide was generally accepted. Oil washing did, of course, lower the calorific value. Regarding the Referee's test, this must certainly be used with care, particularly where the gas under examination was of high sulphur content.

Mr. BALMFORTH remarked that the liming of coal had been used at Cheltenham and also at Halifax; but apparently no specific benefits had been derived. It had been discontinued at the latter place.

Mr. JACKSON mentioned that water gas tar had been used for washing the gas (15 gallons per million c.ft.), but no reduction in sulphur had been noticed.

Mr. GRIFFITHS considered that with so small a quantity there would be very little sulphur removed.

Mr. R. N. WEBB (Leeds) said that the benzole plant had removed 30 p.ct. of the sulphur compounds. Works experience had proved a reduction from 30 to 35 grains to 22 to 23 grains per 100 c.ft. Mr. Webb considered that full charges with the shortest possible carbonizing period reduced the sulphur compounds. Was not the 300 p.ct. increase in sulphur compounds overstating the case against high temperatures? Mr. Webb emphasized the need for efficient retort house practice. This, in many instances, did more than purification in the elimination of sulphur compounds.

Mr. GRIFFITHS said that possibly more sulphur compounds could be removed than was stated, but the plant on which this figure was obtained was not completely stripping the gas for benzole, which might account for the difference. The increased sulphur content of the gas mentioned was certainly not due to temperature increase alone. An increase of 300 p.ct. could be obtained by using very poor coals and maintaining high temperatures. The two factors in conjunction would undoubtedly account for the increase stated.

Mr. Chester proposed a vote of thanks to Mr. Jackson and Mr. Griffiths.

Non-Ferrous Metals Research.

Work in progress or completed is described in a newly-issued report of the British Non-Ferrous Metals Research Association, whose offices are at No. 71, Temple Row, Birmingham. There is no doubt that the Association perform an important duty, in providing an organization by means of which the financial support of individual firms is pooled to foster research—the funds thus rendered available being augmented by a contribution from the Government Research Department. Some twenty-five investigations have been put in hand, and £16,000 a year is now being expended on the work. Some of the researches deal with copper and brass, and others with aluminium, zinc, lead, and nickel. One research in progress has relation to the high-temperature properties of certain non-ferrous metals and alloys. Now that, after an existence of five years, the Association has become firmly established, it is anxious gradually to become self-supporting by an accession of new members from the non-ferrous industry, and from the engineering and other users who stand to benefit.

Hygrometric Tables.

Tables for the computation of relative humidity, vapour pressure, and dew point from readings of dry and wet bulb thermometers exposed in Stevenson screens have been prepared by the Meteorological Office; and they will be brought into use for the preparation of data for publication as from Jan. 1. The tables which have been in use hitherto in this country were prepared by the late James Glaisher, F.R.S. They were based on an empirical formula suggested by numerous observations, which states that the ratio of the depression of the dew point below the dry bulb to the depression of the wet bulb below the dry bulb is a constant for any given dry bulb. The constant ratios for different dry bulbs are known as Glaisher's factors. The present tables have been computed on the basis of Regnault's formula, which states that the depression of the prevailing vapour pressure below the saturation vapour pressure at the temperature of the wet bulb bears a constant ratio to the depression of the wet bulb below the dry bulb, provided the ventilation is constant. This formula, unlike Glaisher's, can be supported by physical reasoning, and it is in general use in other countries. The tables are arranged for temperatures in Fahrenheit degrees and vapour pressures in millibars, and they have been computed for a mean atmospheric pressure of 1000 millibars. They are conveniently arranged to give in one "opening" the relative humidities, the vapour pressures, and the dew points corresponding with a given range of temperatures of the dry bulb and of "depressions of the wet bulb." Copies of these tables can be obtained from H.M. Stationery Office, Adastral House, Kingsway, W.C. 2, price 1s. 6d. net.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Unsealed Dip-Pipes and a Simple Alarm.

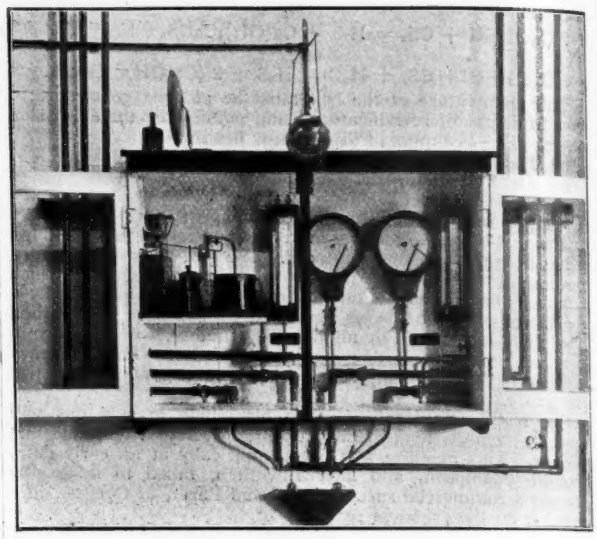
Sir,—As you are aware, in cases of horizontal retort settings where the dip-pipes are uneven, or hydraulic mains are not level, much improved results may be obtained by dispensing with the seal. This, of course, involves a considerable amount of risk in that, should the retort house governors fail, or the exhausters suddenly race, large quantities of air may be drawn up the ascension pipes, and might cause an explosion. I therefore devised a simple alarm which can be adjusted to operate if the vacuum varies as much as one-twentieth of an inch.

The device consists of a sealed gas chamber containing water, on the surface of which the gas pressure from the inlet of the retort house governors acts. This chamber is connected with another of much smaller area, containing a float, so that a small variation in the water-level in the first chamber is multiplied several times in the float chamber. The float is connected to a lever carrying an arm with two nickel points, which, on variation of the vacuum, dip into small mercury baths, forming an electric contact which simultaneously rings an alarm bell and lights a red electric lamp. The arrangement of controls for loading or running-off the water in the retort house governors is arranged in the same case, so that the foremen can control the vacuum from the retort house floor.

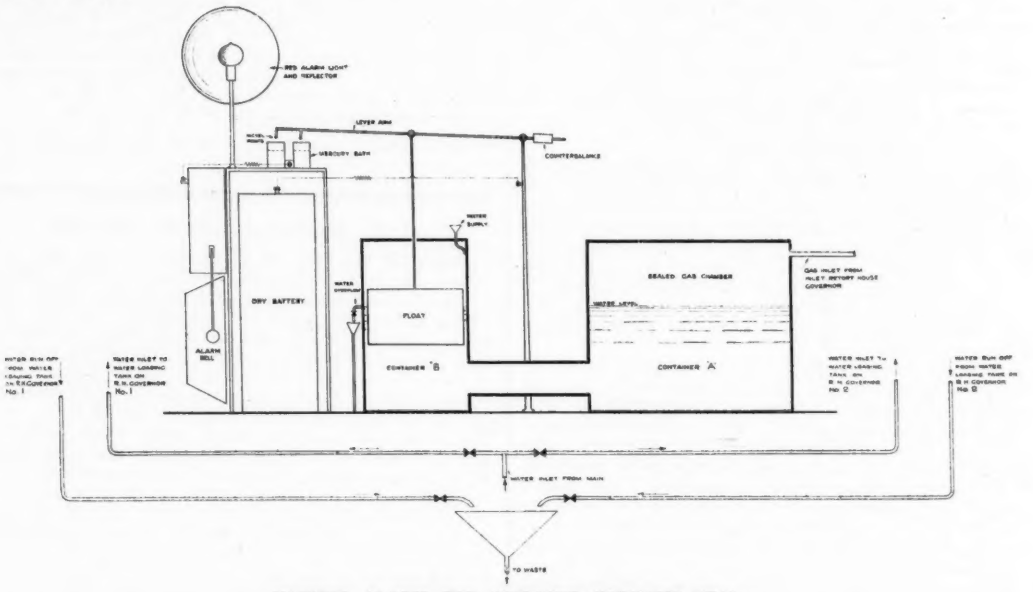
I have found the apparatus to be most effective in action, and you may deem it of some interest to your readers. I am sending you a sectional diagram and photograph of the actual apparatus I have in operation.

Harold E. Copp,
Engineer and Manager.

British Gas Light Company, Ltd.,
Sculcoates, Hull,
March 3, 1925.



VIEW OF CONTROLS.


RED ALARM LIGHT AND REFLECTOR
LEVER ARM
NICKEL-IN POINTS
MERCURY BATH
COUNTERBALANCE
WATER SUPPLY
DRY BATTERY
WATER OVERFLOW
FLOAT
SEALED GAS CHAMBER
GAS INLET FROM INLET RETORT HOUSE GOVERNOR
WATER LEVEL
ALARM BELL
CONTAINER "B"
CONTAINER "A"
WATER INLET TO WATER LOADING TANK ON R.H. GOVERNOR No. 1
WATER INLET TO WATER LOADING TANK ON R.H. GOVERNOR No. 2
WATER RUN OFF FROM WATER LOADING TANK ON R.H. GOVERNOR No. 1
WATER RUN OFF FROM WATER LOADING TANK ON R.H. GOVERNOR No. 2
WATER INLET FROM MAIN
TO WASTE

VACUUM ALARM FOR WORKING WITHOUT SEAL.

REGISTER OF PATENTS.

Gas Cookers.—No. 227,535.

Flavel, W. P., of Leamington Spa.

No. 26,218; Oct. 20, 1923.

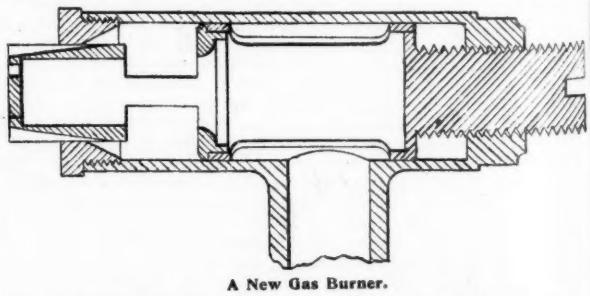
Hitherto, says the patentee, it has been usual to support vessels for cooking purposes upon bars or grids arranged above the burners, and in some cases to use a flat plate with apertures above the burners. In this invention, however, a flat plate top is provided with apertures through which the burner heads pass, so that the flame is burning entirely above the level of the plate. There are studs on the plate, to keep the vessel at the requisite height in relation to the burners. In this way the surface of the plate may be enamelled white and kept clean. Any overflow from a cooking vessel can be cleaned off with ease. The space underneath the plate can be used, for instance, to accommodate plates, tureens, &c. It is stated that economy is effected, because air travelling along the plate to the burner is preheated by the downward radiation of the flame which is spread over the bottom of the cooking vessel. The studs themselves, which may be provided with heat-insulating means, are of semi-spherical form at the end. The lessened area of contact prevents the passage of heat from the vessel above.

Gas Burners.—No. 227,566.

Yates, J. H., M. Howlett & Co., Ltd., and Dolphin, J., all of Birmingham.

No. 28,375; Nov. 10, 1923.

This invention relates to atmospheric gas burners of the kind wherein two valves controlling respectively the inflow of gas supplied to the unit and the outlet area of the unit into the mixing chamber are inter-connected so that the rotation of a screw-threaded stem causes one of the valves to open or close more than once while the other valve is moving once from one extreme position to the other, whereby the ratio of the respective amount of opening of the two valves is progressively varied. The object is an improved construction. The two valves, together with the screw-threaded stem, are constructed as a single unit, the whole of which takes part in the combined rotary and endwise movement as the stem is rotated.



A New Gas Burner.

The inflow valve is of hollow sleeve-like form provided with one or more peripheral ports adapted to register with the gas inlet opening in the valve casing and to be adjusted by rotary movement. The discharge valve is formed as a co-axial extension on the inflow valve, which extension constitutes a valve and is adapted to be adjusted by endwise movement. The turning of the valve unit upon its own

centre will, of course, cause the port of the inflow valve to register more or less with the gas inlet port in the valve casing, so controlling the flow of the gas. As the turning movement of the valve unit, however, takes place upon a screw thread, it is necessarily accompanied by an endwise movement depending in amount upon the pitch of the screw. The valve member which is situated at the discharge point may be in the form of a plug or sleeve having a number of longitudinal grooves upon its periphery, which grooves taper in depth so that the valve can be adjusted through a collar. The area for the flow of gas depends upon the position of the valve relative to the collar. Alternatively, the flow of gas at the discharge point may be controlled by a needle valve.

Gas Meters.—No. 227,601.

SUTHERLAND METER CO., LTD., and KING, F. H. W., both of Birmingham.

No. 31,556; Dec. 17, 1923.

This invention relates to coin-controlled mechanism of the kind wherein a rotary coin carrier is provided with a casing, which also contains a toothed wheel, and wherein the housing is provided with a movable member which is displaced by the insertion of a coin, and forces a lever into engagement with the toothed wheel so that the latter can be turned by turning the housing. A plate is provided for engaging the toothed wheel slid-ably mounted adjacent the outer surface of the coin housing. A pin is mounted upon the housing and passes through a slot in the sliding plate—a further pin being provided upon the sliding plate and serving to connect it with the coin-actuated member. A coil spring is disposed between the two pins, and serves to hold the sliding plate out of engagement with the toothed wheel.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official List" for March 4.]

Nos. 4901-5602.

DEGENHARDT, W. R.—"Apparatus for discharging solid products from retorts, &c." No. 4968.

GLOVER, T.—"Apparatus for washing gaseous fluids." No. 5097.

HANLY, M. M.—"Gas retorts." No. 5033.

KEITH, G., AND JAMES KEITH & BLACKMAN COMPANY, LTD.—"Injectors for gas burners." No. 5138.

MERZ & M'LELLAN.—"Fuel distillation apparatus." No. 5149.

MERZ & M'LELLAN.—"Distillation apparatus, &c." No. 5150.

QUENEAU, A. L. J.—"Retorts for distillation, &c." No. 4952.

QUENEAU, A. L. J.—"Feeding or/and discharging retorts." No. 5064.

QUENEAU, A. L. J.—"Cleaning, &c., retorts while in operation." No. 5065.

RIDER, D.—"Heat-treatment of materials for distillation, &c." No. 5486.

THERMAL, INDUSTRIAL, & CHEMICAL (T.I.C.) RESEARCH COMPANY, LTD.—See Rider, D. No. 5486.

TRIGG, W. J.—"Gas boiling kettles." No. 4936.

WEEKS, E. G.—See Merz & M'Lellan. Nos. 5149, 5150.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Progress of Bills.

The Dundee Corporation Water and Gas Order Confirmation Bill: Read the third time, and passed; received the Royal Assent.

A Select Committee, consisting of Earl Clarendon (Chairman), Earl Lovelace, Lord Tilford, Lord Erskine, and Lord Hindlip, has been appointed, and will meet on Thursday, March 12, to consider the following Bills: Hoylake and West Kirby Urban District Council, Horley District Gas Company (Electricity Supply), and the Bexhill Corporation.

The Rochdale Corporation Bill and the Uckfield Gas and Electricity Bill will be considered on the 18th inst. by a Select Committee, consisting of Earl Spencer, Viscount Novar (Chairman), Lord Sinclair, Lord Templemore, and Lord Lamington.

HOUSE OF COMMONS.

Progress of Bills.

Gas Light and Coke Company Bill: The Standing Orders not previously inquired into have been complied with, and the Bill committed.

Walsall Corporation Bill: Read a second time, and committed.

Gas Regulation Act.

A copy was presented of a draft of a Special Order proposed to be made by the Board of Trade under section 10 of the Act, on the application of the Biggleswade and District Gas Company, Ltd.

As the result of a conference between representatives of the Bolton Corporation and of the Horwich and Turton Councils, the charge for gas is likely, as from the March quarter, to be uniform throughout the whole area of supply. Hitherto there has been a differential charge of 3d. per 1000 c.ft. for outside districts.

MISCELLANEOUS NEWS.

WANDSWORTH, WIMBLEDON, AND EPSOM DISTRICT GAS COMPANY.

Annual General Meeting.

The Ordinary General Meeting of the Company was held on Tuesday of last week, at the Cannon Street Hotel, E.C.—Mr. H. E. JONES (the Chairman) presiding.

The SECRETARY (Mr. C. W. Braine, F.C.I.S.) read the notice convening the meeting, and subsequently a special report of the Auditor, in which reference was made to the price at which the stock of tar had been taken into account, and to certain book debts.

The CHAIRMAN: Well, gentlemen, as to the special report which has had to be read to you, I want to tell you, as your old Chairman of I do not know how many years, that I do not agree with it, and the Directors do not agree with it. It is merely academic, and it creates a difference of opinion between two of your staff—your clever Engineer and your worthy Secretary. But, to put all such questions at rest, my colleagues have told me I should be quite justified, if in future there is the slightest expression of dissent from the form in which the accounts are prepared, in calling in another Auditor—and preferably one who has been working on gas accounts at the Board of Trade for many years—to decide the matter. I have never seen such a report before, and I think it would be desirable in any future case of the kind to have the opinion of such a man as I have referred to. Having made this explanation, I have no doubt that you will, as usual, take the report and accounts as read. [This was agreed to.]

NEVER PROUDER OF THE COMPANY THAN NOW.

Well, now, in spite of that proviso, I may say that I have never been prouder than I am to-day of the position of the little Wandsworth, Wimbledon, and Epsom District Gas Company; and I say this as a man who is 82 years of age, and who came into the service of the Company when he was 18, and more or less has been in it ever since. Whether I have been successful or not, you can, I suppose, have formed some idea, because otherwise our shares would not stand at the very high price at which they are to-day quoted on the Stock Exchange. ["Hear, hear."] I may keep you a little time to-day, because one or two interesting things have happened lately. My colleagues, curiously enough, made me a present the other day of my portrait, which I am sorry is not in the room to-day to show to you. The only fault I have to find with the portrait is that it does not reveal me young enough or, for me, good-looking enough. [Laughter.] However, it is a very fine portrait, and it is very good of them to give it to me. They have also done something more than that. Owing to the illness of our worthy old Secretary (who was away for some months of the year, when it was necessary to approach the Board of Trade when they were examining into our concerns and fixing a new standard price for gas—which will modify your dividend until we reduce the price of gas again, and I shall not rest again until we have done it, though things are rather against it just now), they made me Managing Director, so that I am now responsible for everything, whether it goes right or wrong, from top to bottom [A VOICE: That is right], and I have to justify my position.

DEATH OF A DIRECTOR.

I have begun, I am afraid, in rather a bombastic spirit; but now I have to tell you of a loss we have had to face. We have lost during the year the services of a very valued colleague—Mr. W. G. Langlands. He was a former Director of the Epsom Gas Company, and a very useful Director. As a matter of fact, he was a much bigger man than that, because he was also Clerk of the Course to the Epsom Races, and owned a considerable share in that undertaking, and in many other concerns. One of the services which he rendered to us as a Company was to secure for us a great many acres of land round our works at Epsom, the value of which in future days it is impossible to exaggerate. You know what it is to be carrying on an industry like a gas-works with a lot of neighbours. It is always best to have plenty of land around you, so as to be able to do the necessarily dirty work of a gas company—tar distilling, and so forth—in a corner without offending anybody's eyes, nose, or ears. That we have always done, and we have there about 50 acres of land. Mr. Langlands was a dear fellow, and we on this side are very sorry to lose him. He was a cordial, kind representative, and I am sure that those of you who come from the Epsom district will realize that in him we have lost a most valuable man.

STANDARD PRICE REVISION.

I will now go back to the fact that we have had a revision of our standard price of gas. Curiously enough, two other companies with which I am connected have also had to appear before the Board of Trade for revision, and their standards have been put down by the Director of Gas Administration at the Board of Trade to a greater extent than has been the case with us. The secret of this is that our first application for a standard price was on a very modest basis, and they gave us all that we asked for. As a matter of fact, we were able to prove that we were entitled to more; but the Director said: "You have not asked for more, and I cannot give it you." That, of course, was our own fault; but it is partly rectified now, because we have secured by no means bad standard prices at 14d. per therm for Wandsworth—in our best and cheapest district—12d. in our Wimbledon area, and 14d. in Epsom, which is comparatively a very small thing.

THE PRICE OF GAS.

Now, this is a bad time at which to talk about the price of gas. I have been at three or four gas company meetings recently, and, with the exception of one—a very prosperous Company, who always have plenty of money—they all spoke rather feelingly about the loss

which is now being made on residuals (even more feelingly than our own Auditor has done) and about how this would lead, sooner or later, to the necessity of raising the price of gas. I have been discussing that with some of the influential people in the gas world in London, and it is quite clear that the price of gas, generally, is too low. I do not think it is much too low for us, in our circumstances; and we shall do, as we always have done, our level best to make the gas cheaper if we can, and avoid raising it. But I do think you will realize that the price of gas will have to be raised in the greater part of London. Of course, gas lighting by means of the Welsbach burner, consuming as little as it does, is a very formidable opponent to the electricity people. So little gas is consumed by this method that it never will be too dear, within reason, for lighting purposes; but when you come to ask a man to put gas into his fire-places, and to burn it to cook his food, to warm himself, and to heat his house, you must give him cheap fuel. It is not only our duty to do so, but we want, also, to promote our business, and to add to the enormous number of appliances used for domestic purposes, which are all largely of a labour-saving nature, as well as money-saving. You have in all this to keep in view the necessity of preserving the sympathy of the consumers by serving them well and cheaply. That is one of the facts on which I wish to lay stress.

FURTHER CAPITAL ISSUED.

The next matter to which I wish to draw your attention is that in November last we raised a large amount of fresh capital. You may say that this was an undesirable course to adopt, while prices of things are going up; but we cannot resist the obligation to spend more money, especially when the question of distributing gas comes up. The Gas Regulation Act, under which the Board of Trade deal with us, exacts from us to-day a pressure in our pipes four times as great as that which was demanded before. The necessary pressure used to be equivalent to ½ in. of water; to-day it is equivalent to 2 in. of water—and there is a penalty for not fulfilling that requirement, so that we cannot neglect it. Without necessarily adding to the sale of gas, you have got to provide this pressure. To do this involves, in a district like ours, which has something like 370 miles of mains, not only seeing that the required volume of gas is delivered at all points of the system, but that the penalty pressure is also maintained. This has led us into very large outlays of capital for mains. We have spent something like £31,000 in the last year from capital, in addition to a large sum of money spent on mains from revenue. Not merely so, but we have, like all companies that expand and develop, reached the point at which some of our old plant has become altogether too small and obsolete; and I am gratified to think your Auditor did go down and satisfy himself regarding the taking up of some money purposely put by to provide for the replacement and removal of plant. We have done away with an old hand-worked retort house at one end of our district, which was only an extension of what I found at the works forty years ago. It was very expensive, because it cost three times as much for labour as the other retort houses at Wandsworth and Mitcham. Therefore it had to come down. It is a very bad time for such work, because everything is very dear; but we could not go on losing this money, which was being lost to the consumers of gas as well as to ourselves. So we have replaced it by one of the most modern forms of retort designed by our Chief Engineer, Mr. Croft. Now I am going to boast again. I may say that Mr. Croft succeeded so well with the last retort house he built at Wandsworth, and got such good returns, that the Corporation of Glasgow have on two occasions sent inspectors to our works to test, and have decided that the next extension of the Glasgow Gas-Works should be on the lines on which Mr. Croft has been working. [Applause.] I think this shows that we are up-to-date, because the Scotsman is a very canny gentleman, and does not throw his money about without satisfying himself that what he is going to get is the right thing. I think that this tribute to our Chief Engineer will go down, for all time, as a great testimonial to him. He is a conscientious and careful worker. As to the capital we raised, I may point out that we had been spending money for several years. We wanted these extensions even before the war; during the war we could not get them; and after the war things were at a price that rendered them uneconomical. But ultimately the expenditure had to be faced; otherwise we should have had to incur penalties under the Act. Unfortunately, when you lay mains they may not always be immediately fruitful. Where there are housing schemes, for instance, we have had to lay mains for a very unprofitable sort of supply; and, though the municipal bodies pay us some part of the outlay to induce us to lay them, it has been largely in order to be public-spirited and patriotic that we have gone on laying mains for these houses, with no really great advantage to ourselves. There is one disadvantage, and that is that the municipal bodies are rather slow in paying us this money; they make the excuse that the Ministry of Health has not given them their final certificate.

LOW RATIO OF CAPITAL TO OUTPUT.

As things are, we find to-day that we have barely enough money to pay our debts and pay your dividend. We have borrowed very largely from the bank, and we were paying during the war as much as 7 p.ct. for some of the money they lent us. However, I can say that, in spite of the raising of this fresh capital, in spite of our large outlay, our capital to-day stands at the low figure of 7s. 11d. per 1000 c.ft., or £398 per million. That figure covers not only the gas-works, mains and services, and fittings of an ordinary gas company, but also—for we are right up the Thames, away from London, on the other side—a fleet of ocean-going steamers that bring coal for us straight from Newcastle to our works, and that is one of the secrets of our low price of gas, of which Mr. Croft and the other Directors are very proud. We supply gas at the lowest price in London. Although one company has been aiming at competing with us, I think they have been compelled to raise their price. Another thing of which we are very proud is that we have coal carbonizing works for the whole of our delivery. We have some water gas plant, but at the present price of oil and coke it does not pay to work it. We keep it by us, and we work it to a margin of 10 p.ct.; but those who are working water gas in large proportions will be driven by questions of economy to replace it by coal gas. The cost of water gas plant is little over one-quarter that of coal carbonizing plant, and the repairs and labour are also about one-quarter, so that there is every temptation to use it. But the oil which is essential to give the necessary thermal value is getting dearer every day, and, with the use of it in steamships, is likely to go to a still higher price. If you have any doubt about our position, I recommend you to visit the Wandsworth Gas-Works, where you will see we have some 25 acres of land, giving us ample room, and a noble wharf with ocean-going steamers alongside. We have the further advantage there that we can extend the wharf considerably. We have recently gone into that matter, and have bought some adjoining land close to the River Wandle, and three or four wharves; and we can have about the finest gas property in England. These things are all to the good, and, when you are disposed to be disquieted or unhappy about any matter connected with the Company, I can assure you that you have all the means, with capable hands to work them, for supplying the cheapest gas in London, and with the most benefit to the consumers.

GAS SALES NEARLY 6½ P.CT. UP.

I have explained why our repairs are so heavy. They are at least 2d. per 1000 c.ft. more than I like to see them on the works, and on the district they are also 2d. or 3d. per 1000 c.ft. more than I care about. But this will have to go on until we get rid of the pressure penalty difficulty. On the credit side of the accounts you will see that we have the large increase of 6·4 p.ct. in the quantity of gas sold. That was accomplished with about 10 p.ct. of water gas. The residual products are down, and are going to be lower. The fact is that gas companies have been living in a "fool's paradise," so far as coke is concerned, for some time past. Owing to the Ruhr occupation by the French, the German mines were closed. Then our tar, which makes good roads, also makes good pitch for artificial fuel. As a consequence of these facts, the price of these products went to an abnormal figure. I always thought the price was ephemeral, and I told my gas friends for two or three years that it would pass away, because the mines to which I have referred would be reopened, and then so much coke would not be exported. One reason why coke must be cheaper is that gas has displaced it in the poor man's house, as a result of our giving him a gas fire with a penny-in-the-slot meter. Prepayment meters are almost universal in the small London houses, where the convenience resulting from obtaining fuel for cooking by turning on a tap is greatly appreciated. The result is that, by displacing coke and coal fires by gas fires, we automatically contribute to our own coke making, because when you make gas you also make coke. In other words, the more gas you sell the more coke you make, whether you want it or not. Of course, if you make water gas that gets rid of some of the coke; but if you want to conserve the fuel of the country, you will not make coke into water gas, because, although the gas is convenient, the thermal value of a pound of coke is a great deal higher than that of the gas you will get from it.

THE SULPHURIC ACID POSITION.

With reference to the rest of the residuals, I have every confidence except with regard to one—ammonia. Why is that giving us low value to-day? The fact is that during the war acid production was stimulated unduly by war needs. A great many people built acid plants, and to-day are seeking to get a dividend on their capital. Although the sale of acid for all purposes in this country has fallen to about one-fifth of what it was during the war, you cannot buy acid to-day reasonably. I put up an acid plant for the Commercial Gas Company some thirty years ago, which always worked very well. All large gas-works ought to have an acid plant for making sulphate of ammonia, because you produce sulphur in your gas and you take it out to please the consumer. You have thus got it on the premises, and you can turn it into acid. We ourselves have all the means, and that is our next job. Mr. Croft and I have talked things over; but the price of lead is enormous. Directly we put up that plant, you will see the returns from ammonia jump up marvellously, because we shall not be paying an exorbitant price for acid, but shall make it from our own products. We have the fuel to distil it from the raw material in the shape of sulphur collected every day from the purifiers.

NEW SHOWROOM AT TOOTING.

Now I want to tell you something of a different character. We have just opened a fresh showroom in Upper Tooting; and, although I do not believe in too much of the ironmongery business for a gas company, there is no doubt that these showrooms do promote the use of gas, because our representatives there instruct people how to use it cheaply and conveniently. I would like to tell you something of the power of your gas as used, not in the dwelling house, but in the factory. At the last showroom I saw opened in the East of London there was a demonstration by a man who cut through sheet iron as if it were tripe, with a gas jet combined with some oxygen. That jet sliced through the iron as a knife goes through butter. That gentleman will very soon exhibit a plant in all the showrooms belonging to the Wandsworth Company. He told me that you can do for 1d. with gas what, if you used acetylene (as you see it constantly used on the tramways), would cost you 3s. That is something for us to think about. I could hardly believe that it was true. I am a practical mechanical engineer, and I know roughly what it costs to cut through iron. When he told me that the operation referred to cost only 1d. as against 3s. with acetylene, I realized that "my old friend gas," with which I have lived all my life, is still of great value. I have now been more than sixty years in gas, having gone to work at the age of 15. I am extremely proud to-day to be in gas, and above all to be in the Wandsworth Company. It is the richest and best-equipped property of all the gas undertakings in this country. When the rating surveyor comes down to rate us, he cannot find much to assess, because all these things which we have working for us are not subject to rates. The part which is subject to rates is quite a small fraction of the whole. We have a magnifi-

cent plant, consisting very largely of materials which are not assessable for the poor rate at all, being what are called "chattels and utensils of trade" peculiar to the business.

TAR PRICES.

Now I want to tell you what your tar realizes. The tar of this Company in the year under review realized 2·76d. per 1000 c.ft. of gas. In the Commercial Company it realized 2·58d.; in the Gas Light and Coke Company, 2·57d.; in the South Metropolitan Company, 2·54d.; in the South Suburban Company, 3·28d.; and in the Brentford Company 2·26d. The last-named make a great deal of water gas, and therefore cannot have as much tar to sell as the others. The average of the other Companies is 2·74d., and that at Wandsworth is 2·76d., per 1000 c.ft. When I received the Auditor's report the other day, inviting us to upset these accounts, or at any rate to recast them at the eleventh hour, I found that our Engineer had already sold more than half the tar at a price considerably above the figure at which he had included it in the accounts. Therefore I said, "We will let the accounts go, and give the consumer the benefit." ["Hear, hear."] I beg to move the adoption of the report and accounts.

The DEPUTY-CHAIRMAN (Mr. R. Garraway Rice) seconded the resolution, which was unanimously carried without discussion.

THE DIVIDENDS.

The CHAIRMAN said the next business was to propose the dividends recommended in the report, and in this matter they had now reached the great object for which they had been working since the war—to get the dividend up so that new capital could be issued at par or above it. It was against the consumer's interest to issue capital at a discount. The ordinary stock now stood a trifle above par. The dividend recommended that day on the ordinary stock was at the rate per annum of £6 9s. 6d. p.ct. He thought on this the next dividend, under the new standard, would be £6 4s. 3d. He was sorry for it, and the Board would do their best to remedy it. On the Wimbledon stock the dividend recommended was at the rate per annum of £7 7s. 6d. p.ct., which was rather high. On the Wandsworth "B" it was £7 15s. p.ct.; but this was stock created in the old 7 p.ct. days. The Wandsworth "A" stock was to have £9 5s. p.ct., but there was only £30,000 of this, and it was what might be called the "founders' stock," chiefly belonging to the family of Howell. On the preference stock the dividend was, of course, 5 p.ct. Then they had to pay a dividend for one month only on £100,000 of preference stock at 5 p.ct. per annum, and on £30,000 of new ordinary stock at £6 9s. 6d. p.ct.

The DEPUTY-CHAIRMAN seconded the motion to this effect, and it was agreed to.

RE-ELECTIONS.

The CHAIRMAN said he had now the pleasure to propose the re-election of four of his colleagues. The first was Mr. R. Garraway Rice, lately the Chairman of the Mitcham Gas Company. He wanted to tell them this about the alliance between the Mitcham and Wandsworth Companies. Never could he have imagined it would be possible to find five or six gentlemen coming over to a fresh Government—forming a new Cabinet, so to speak—who could be so cordial, so friendly, so helpful, and so genial, as the gentlemen they took over from the Mitcham Company, of whom Mr. Garraway Rice was at the head. Then there was the grandson of the founder of the Company, Mr. J. B. Howell. Next he came to his own namesake—who had been brought up in the right school. He was on so many gas companies that it was his own fault if he did not know all there was to be known. Finally, there was Mr. B. R. Green, formerly Engineer to the Mitcham Company. He was too valuable to be left as an Engineer, and so they secured his services on the Board. He seemed to be getting on to other Boards as well.

Dr. T. A. IVES HOWELL seconded the re-election of these Directors; and the resolution was passed unanimously.

Proposed by Mr. POTTER, the retiring Auditor (Mr. H. W. Smith), who was unfortunately unable through indisposition to be present, was re-appointed.

VOTES OF THANKS.

The CHAIRMAN, referring to the recent illness of the Secretary, asked the stockholders to join with him in congratulating Mr. Braine upon the recovery that he had made. They all were delighted to have their much-valued friend with them—one who had been for so many years the devoted and loyal Secretary to the Company. He also asked them to join with him in thanking Mr. Croft, their promising and able young Chief Engineer, and the other officers of the Company, and, indeed, the whole of the staff, including the workmen, for their devoted services during the year under review. In moving the resolution, he alluded to the high percentage which accrued to the workmen under the Company's profit-sharing scheme; the percentage amounting to 14½. They were very proud of their profit-sharing scheme, and also of the amount of capital which their employees held in the Company. This should please Mr. Clynes, who was a very sound man, and who had said: "If you expect the working man to give you of his best, you must give him a proper share of what he accomplishes by his production." Under their scheme, every workman who took £200 a year got a bonus equal to about £30. A little while ago he wanted some of the money to be given to the men at once. Food was very dear, and he suggested that they should each draw 2s. a week out of the profit-sharing; but nearly all the men declined, saying they would endure any hardship rather than touch their slender capital. Was not this proof that profit-sharing was good? If they were liberal, as their Company were, they did get the best out of their men. He would ask Mr. Frank Jones, as Chairman of the Works Committee, to second this.

Mr. FRANK H. JONES, in seconding, said the Company had a very fine lot of men, and the profit-sharing system worked excellently.

The motion having been heartily carried,

Mr. BRAINE expressed his gratitude for all the kind things that had been said. Referring to the profit-sharing scheme, he said the total dividend paid to the men amounted to nearly £1500 for the half-year. This was something considerable to go into their pockets, and averaged 25s. each. For this they were very thankful. He was glad to say he had recovered from his illness, and, so long as he was Secretary, the proprietors could rely upon him, with the assistance of his very able staff, to carry on the business.

Mr. C. M. CROFT also returned thanks, and assured the Directors and stockholders that unless he had had the loyal co-operation of both officers and workmen to which the Chairman had referred, they could not have got the results that had been achieved during the past year.

Mr. HENNELL proposed, and Mr. POTTER seconded, a hearty vote of thanks to the Chairman and Directors—the latter remarking: "You need not worry about the special report of the Auditor, because we have every confidence in the Board."

The CHAIRMAN, in acknowledgment, repeated that he was very proud of the Company, which had been his life's study. His Directorships extended from Bombay to Buenos Aires, and through the most fruitful parts of France, so that he could not be regarded as a child in gas administration or finance.

MECHANICAL HANDLING DEVICES.

A Lecture at the Regent Street Polytechnic.

The creation of new wealth and the increase of production are being recognized as the practical solution of the many problems resulting from industrial depression, loss of markets, and curtailment of trade. An acceptance of this, and the adoption of efficient methods are being stimulated by the Industrial League Council by a series of lectures on works organization and management conducted at the Regent Street Polytechnic. One of the most important of this series was held on Tuesday, Feb. 24, when Major F. M. DU PLAT-TAYLOR, M.Inst.C.E., lectured on "Mechanical Handling Devices."

MECHANICAL PLANT IN RELATION TO LABOUR.

Having suggested that mechanical handling devices were probably the earliest form of mechanical appliance, and that little doubt existed as to their being used in raising and lowering the materials for the Pyramids, Solomon's Temple, and Stonehenge, the lecturer touched upon two aspects of mechanical plant in relation to labour generally. This class of appliance is, he said, one of the principal of those coming under the designation of labour-saving plant, and as such has frequently come under the ban of trades unions in various trades. It is true that the term "labour-aiding," instead of "labour-saving," has been applied; but the common-sense view is that mechanical handling devices do save unintelligent labour, or the mere drudgery of hauling, lifting, and carrying heavy weights year in and year out; but at the same time, by largely increasing the output of works, they find employment for a larger number of men in intelligent labour for which they are more fitted by the modern benefits of education, and in which they can take an active interest. While, however, these devices make for efficiency, they undoubtedly present more risk of accident, unless care is taken to fence all moving parts where there is risk of contact, to examine frequently, test, anneal, &c., chains and ropes used for lifting, and to train the staff as to the management of such appliances. Regarding the examination and testing of plant, chains, and gear, the procedure is laid down by the Regulations made by the Secretary of State for Home Affairs under the Factory and Workshop Acts. As to chains and lifting gear, the methods of examination are described in Safety Pamphlet No. 3, issued by the Home Office last year. This contains several useful tables and formulæ. Wire ropes occasion more difficulty, as they cannot be tested from time to time, and the only guide is a test of a portion of the rope to destruction, when new. This question is now under discussion by several technical committees, and no doubt a standard will be laid down before long. Until this takes place, however, it is recommended that the factor of safety for any such rope should be 8—*i.e.*, it should not be subjected in working to more than one-eighth of the breaking load as certified by the makers.

TRAINING OF THE STAFF.

Major Plat-Taylor considers the training of the staff in the use of mechanical handling devices a matter of paramount importance. In his experience he has found that careless and dangerous practices—such as men going up on crane hooks to the upper floors of buildings, or cranes being used to haul railway trucks horizontally—are often indulged in by those who should know better. The best way to ensure compliance with the ordinary requirements for safety is to form in the works a "safety-first" committee, consisting of an equal number of nominees of the employers and the workmen. The committee investigate all accidents occurring on the works, and advise the employers as to any measure they think desirable to prevent recurrence. They prepare and post-up notices in regard to dangerous practices, and generally educate the workmen in the matter of safety precautions.

The lecturer, by a number of most interesting slides, explained the progress made in the development of mechanical handling. The functions of the appliances, which included examples of modern cranes, conveyors, trucks, &c., were lucidly demonstrated; and kinematograph films added interest to the lecture.

The Eveson Case Appeal.—In an action for damages brought by the widow of the late Mr. Harold George Eveson, Director and Manager of the G. J. Eveson Coal & Coke Company, Ltd., Birmingham, against Ansell's Brewery, Ltd., in connection with the fatal accident which occurred to Mr. Eveson, as reported in our issue of April 2 last, Mrs. Eveson was awarded £5000. Notice of appeal was given by the Brewery Company. We are now informed that the appeal has been withdrawn, and the damages paid over, together with the costs of the action.

NORTH MIDDLESEX GAS COMPANY.

Increase of 14¼ P.Ct. in Gas Sales.

The Ordinary General Meeting of the Company was held on Monday of last week, at No. 5, Great Winchester Street, E.C.—Mr. A. M. Paddon (the Chairman) presiding.

The Secretary (Mr. E. L. Burton, F.S.A.A.) read the notice convening the meeting, and the report and accounts for the year ended Dec. 31 were taken as read.

The Chairman, before proceeding to move their adoption, made feeling allusion to the great loss sustained by the Company through the death of Mr. A. F. Phillips. The Directors had, he said, appointed to fill the vacancy thus created Mr. Frank H. Jones; and the Company were to be congratulated upon having acquired in Mr. Jones the co-operation of perhaps the most prominent consulting gas engineer of the day. Turning to the report, it would be seen that the Company had made very material progress during the year; the sales of gas, as compared with 1923, showing an increase of 332,770 therms, or 14·5 p.ct. With regard to the accounts, it was almost impossible to gauge their relative merits or deficiencies unless one took into consideration the price at which they had been selling gas during the period referred to. It would have been perfectly easy to present a far larger margin of profit, and more favourable figures in almost every respect, if gas had been sold at a higher price; but the Directors conceived that they should sell it, in the circumstances, at the very lowest figure at which it was practicable to do so. Therefore, tney had reduced the price at the beginning of the year to 9½d. per therm, which was less than was charged by some very much larger undertakings. The accounts revealed how nearly the Company had approached exhaustion point in regard to capital. They had only some £18,000 of share capital to issue, and £9300 of debentures, before their powers were altogether depleted; and the Directors had already made arrangements for the issue of the fragmentary amounts which remained at their disposal. But the accounts further revealed that the capital was over-spent to the extent of £11,688; and in the balance-sheet there was a suspense account of £10,751, as well as a loan from bankers of £27,500. In due course the proprietors would be informed of the terms of the new issue, and he hoped they would support it. Taking into account all the figures he had quoted, it would be seen that the capital per million c.ft. of gas sold was under £600, and this would exculpate the Board from any charge of being wasteful in expenditure. They had sold gas throughout the year at 9½d. per therm, in contrast with 10½d. during 1923; and the difference to the consumer was about £11,000, which was a handsome concession, and a wise one in the special circumstances. Theirs was a very rapidly developing district; and when new streets of houses were running up, and a fresh population was moving into the district, one could not do better to create an atmosphere of confidence in the undertaking than to sell at a low price, so as to make gas applicable to all the requirements of the household. To-day, particularly in the smaller dwellings, gas did the cooking, warming, and water heating—in fact, it did everything that could possibly be achieved by it in reducing labour and displacing the domestic servant. Therefore, it had been a great point with the Company to place a cheap and thoroughly good supply of gas at the disposal of the public. The total receipts from gas and meter, &c., rentals, in spite of the reduction, were £4259 more, and the total receipts were nearly £5000 up. On the other side of the revenue account, coal, oil, and coke had cost £7000 more. The total maintenance charges in the revenue account came to over 17d. per 1000 c.ft., which showed that nothing necessary in this respect had been curtailed. More than £2000 had been devoted to the co-partnership fund, sick and benefit club, and pensions fund. Co-partnership with their Company had had a brief history, but a very eventful one; and it had thriven amazingly. An abnormal spirit of co-partnership manifested itself in their men. He did not think there was a higher standard of work or a better spirit of service than was to be found in their Company. They had been compensated over and over again for having adopted the system.

Mr. H. A. Lermitte seconded the resolution, which was warmly supported by Mr. G. W. Carey and Sir Henry Kimber, and carried unanimously.

Dividends were declared making in the case of the original ordinary and additional ordinary shares a distribution for the year of 11½ p.ct. and £8 1s. p.ct. respectively, less income-tax; and the sum of £852 was carried to the reserve fund. It was pointed out by the Chairman that a little more dividend was being paid on the present occasion.

Mr. Paddon was re-elected a Director, and the Auditor (Mr. Lewis Hardy, F.C.A.) was also reappointed.

A hearty vote of thanks was passed to the Secretary, the Engineer and Manager (Mr. Lawrie Trewby), their staffs, and the co-partners generally, on the proposition of the Chairman, seconded by Mr. Carey.

Mr. Burton having responded on behalf of himself and his staff,

Mr. Lawrie Trewby acknowledged the vote on behalf of the works. He pointed out that the Company were now selling gas at 25 p.ct. more than pre-war, and of the same quality; and he remarked that there were not many things one could buy to-day on those terms

Mr. J. R. Gale, on behalf of the Co-Partnership Committee, also returned thanks, and spoke of the great success that had attended the introduction of the system at Mill Hill.

A vote of thanks to the Chairman and Directors brought the proceedings to a close.

Necessity for Legislation with Regard to Smoke Abatement.—A Chadwick Public Lecture was delivered by Lord Newton, D.L., J.P., in the Inner Temple Hall, London, on Monday last, in which he emphasized the urgent need for legislation to secure the abatement of the smoke nuisance. The present Minister of Health, he said, has intimated that there is no time to pass a Bill this year, but that he will endeavour to introduce one early next year.

GAS COMPANY RESULTS IN 1924.

Andover.

The annual meeting of the Andover Lighting and Power Company was held on Feb. 26—Mr. W. P. Clarke, Chairman, presiding. From the accounts, it appears that during the year 46,895,800 c.ft. of gas were sold—an increase of nearly 10 p.ct. The price of gas for power purposes was reduced by 1d. per therm in March last, and the Directors announced a further all-round reduction of ½d. per therm. Mr. Clarke referred to the death of Mr. Stephen Temblett, who had managed the business of the Company for over 35 years, and the appointment of his son, Mr. G. T. Temblett, in his stead. The credit balance was £2052, out of which the Directors recommended the payment of the following dividends: For the half-year ended Dec. 31, 1924, at the rate of 5 p.ct. per annum (less income-tax), and at the same rate for the half-year ending June 30, 1925.

Cheltenham.

Presiding at the annual meeting of the Company on March 2, Mr. C. L. Grundy said that, though the average price of coal had been slightly less than in the previous year, the cost to the concern had been heavier, owing to the larger quantity carbonized and to the fact that they were carrying a larger stock of coal than usual. The income from the sale of gas had diminished by about £10,000, owing to the decrease in price; but the increase in the quantity of gas sold of 40 million c.ft. showed how much the reduced price encouraged consumption. Sales of gas to private consumers last year represented an increase of about 9½ p.ct. above the previous year. Rentals from meters and stoves increased by about £500, and receipts from residuals showed an advance of about £7000. The reserve fund had now entirely disappeared. It had been found useful during the period when the Company had to spend such large sums in renewals at the works. The Directors would restore it as soon as practicable. Referring to the wages question, the Chairman pointed out that, so far as Cheltenham was concerned, the increase in the cost of gas was at present more than 83 p.ct. above the pre-war price, and in excess of the increase in the cost of living, which was 79 p.ct. The gas-workers at Cheltenham were receiving 115 p.ct. above their pre-war wages. In face of these figures, there would be considerable difficulty in justifying any increase in wages.

Cork.

The report submitted at the 112th ordinary general meeting of the Cork Gas Consumers' Company, over which Mr. W. B. Harrington presided, stated that, as compared with the corresponding period of 1923, there had been a falling off in the sales of gas, principally due to the reduced prices. There was also a reduction in the residuals accounts, mainly due to the low prices ruling for most residual products and to the fact that sales in the previous year had been greatly increased by the demand for coke for household purposes during a period of industrial trouble. The balance of profit and loss was £4087. The dividend proposed was the usual one at the rate of 8 p.ct. per annum. The Chairman, in moving the adoption of the report and statement of accounts, said the falling off in gas sales was barely ½ p.ct. compared with the same period in 1923, when the consumption was the highest on record. They had fixed 423 gas stoves and appliances during the half-year—an increase of 123 over the corresponding period of 1923.

Eastbourne.

It was stated in the report which was adopted at the annual meeting of the Eastbourne Gas Company last Friday that the sales of gas showed an increase of 6½ p.ct., and the number of consumers had also grown. As from the commencement of the present year, the price of gas has been further reduced from 10d. to 9·4d. per therm. Following an application by the Eastbourne Corporation to the Board of Trade, the standard price for gas has been reduced from 18·6d. to 14·6d. per therm. Mr. Frank H. Jones (the Deputy-Chairman), in seconding the adoption of the report and accounts, pointed out that the capital per million c.ft. of gas sold amounted to only £423. The total quantity of gas sold was 555 million c.ft. Further money is required to meet the growing demands, and this it is proposed to secure by the issue of £50,000 of debenture stock. In the course of the discussion gratification was expressed at the success of the co-partnership scheme.

East Grinstead.

The general meeting of the Company was held on Feb. 26. Mr. W. H. Hills (Chairman), in moving the adoption of the report and accounts, said that the total expenditure on gas account was £18,646, and the income £21,545. In January, 1924, they reduced the price of gas by over 4d. per 1000 c.ft. The sales had increased by one million c.ft. The Directors had been able to increase the dividend for the year to 10 p.ct. and 7 p.ct. respectively on the two classes of shares, and leave £6243 to be carried forward. They had entered into an agreement with a neighbouring Company to supply them with gas in bulk. Mr. A. H. Neve proposed a vote of thanks to the staff, to which Mr. D. T. Livesey (Secretary and Manager) replied.

Gloucester.

The half-yearly report of the Directors of the Gloucester Gas Light Company was submitted at the meeting by the Chairman (Mr. J. H. Jones), who said he thought the proprietors would consider it satisfactory. The balance of profit was not sufficient to meet the half-year's dividend, but this was fully anticipated when the last general reduction was made in the price of gas of 6d. per 1000 c.ft. Altogether they had come down from 4s. 10d. to 3s. per 1000 c.ft. It was a great satisfaction that complaints on account of naphthalene had been reduced from 674 in December, 1920, to 46 in December, 1924. The present average of complaints was not much beyond one a day. A dividend at the rate of 5 p.ct. per annum, less income-tax, was declared upon the consolidated stock of the Company for the six months ended Dec. 31.

Halesowen.

The report for the year ended Dec. 31, submitted at the annual meeting of the Halesowen Gas Company, showed a profit of £2793;

there being a satisfactory increase from the sales of gas and residuals. It was decided to pay final dividends at the rate of 12 p.c. per annum on the "A" shares (making 11 p.c. for the year), and £8 8s. p.c. on the "B" shares (making £7 14s. p.c. for the year), less tax, to place £1000 to the renewals account, and to carry forward £427. It was reported that an Order had been sanctioned by the Board of Trade, giving them, among other things, power to raise additional capital, to carry out extra works, and to add various parishes to the Company's area of supply.

Harrogate.

Increased sales of gas amounting to 4·2 p.ct. were reported by the Chairman (Mr. Francis Barber) at the annual meeting of the Harrogate Gas Company. A reduction of 1d. per therm in the charge for gas, an increased price for coal, and a falling-off in the value of residual products, resulted in the profit for 1924 being £14,470, as compared with £22,251 for 1923. In the circumstances an increase in the price of gas is necessary. The co-partnership scheme in operation has fulfilled the expectations of the Board. The number of co-partners is now 168, and 96 of them have taken advantage of a voluntary savings scheme. An Order has been applied for to the Board of Trade to enable the Company to acquire the undertaking of the Pateley Bridge Gas, Coal, and Coke Company and to supply gas in their area. A canvass of the probable consumers in the district proposed to be included has yielded most satisfactory results. A dividend at the maximum rate was declared.

Hastings.

The half-yearly meeting of the Company was held on March 5—Mr. W. J. Glenister presiding. The accounts for the half-year ended Dec. 31 show a balance of £12,633. The sale of 509 million c.ft. during the year—an increase of 3¾ p.ct.—constitutes a record in the history of the Company. In the same period the number of consumers increased by 439. A new 12-in. feeder main is being laid to Hollington, and the mains have been extended in Baldslow to the limit of the Company's area. The Chairman, referring to the accounts, said that, on the income side, the sale of gas realized £56,124, as against £58,072 for the corresponding period of the previous year; and the income from residuals was £11,320, as against £10,071. The balance carried forward to the next account was over £42,000, while the profit was £12,633. The quantity of gas sold during the half-year was 254 million c.ft., compared with 252 millions. No fewer than 3858 orders had been handled by the fitting department. The Directors recommended payment of dividends (less income-tax) at the same rates as those in the preceding half-year, as follows: £6 15s. p.ct. per annum on the 5 p.ct. converted stock; £5 5s. p.ct. on the 3½ p.ct. converted stock; and £6 4s. p.ct. on the 5 p.ct. additional stock. A vote of thanks to the Directors, the Manager, and staff was replied to by the Chairman and Mr. C. F. Botley.

Ipswich.

The Company held their annual meeting on Feb. 25; the chair being taken by Mr. Henry Woodall. The Chairman, in proposing the adoption of the report and balance-sheet, said that the output of 720 million c.ft. constituted a record. During the year they had enlarged and improved their offices and showrooms, and had also rebuilt the offices and stores at the works. They had issued £3500 new capital, to provide stock for the co-partners, and had increased their loan capital by £1550. The capital account was now overspent by £11,100, and the Board would shortly be raising more capital. Every house built by the Housing Committee of Ipswich had a supply of gas. The receipts from residual products were nearly the same as in 1923. This good result was largely due to the purchase and use of the tar works. The result of their working was that they had a balance of profit for the year of £15,002; and they proposed to pay the full standard dividend.

Oxford.

The annual meeting of the Company took place on Monday, March 2—Alderman F. W. Ansell (the Chairman) presiding. After pointing out that the accounts were only for the half-year, the Chairman said that on the expenditure side two new items would be noticed—special purposes fund and renewal fund, each £750. The former fund took the place of the old insurance fund, but could be used for other purposes, and the renewal fund was for equalizing expenditure on renewals, instead of having to increase the price of gas to meet some extraordinary expenditure. Receipts for gas were not quite half those for the year ended June 30. The return for secondary products had maintained the high standard of about 70 p.ct. on the cost of coal. A new gasholder was brought into commission in September, and had proved very helpful. Good progress was being made in the construction of a new section at the gas-works on the south side of the river, to meet the increasing demand for gas. The Chairman then moved that a dividend be paid on the preference stock for the half-year ended Dec. 31 at the rate of 5 p.ct. per annum, and on the consolidated ordinary stock at the rate of 10 p.ct. per annum. This was seconded by Dr. G. C. Druce, and carried unanimously. In reply to a vote of thanks to the staff, Mr. W. E. Caton, General Manager and Engineer, said that during the past half-year the number of consumers had increased by 268, the number of cookers by 341, fires by 605, and geysers, &c., by 85. At the extraordinary meeting which followed, a resolution empowering the Directors to raise additional capital was carried unanimously.

Rowley Regis and Blackheath.

At the annual meeting of the Rowley Regis and Blackheath Gas Company, the Directors reported a further increase in the sales of gas. It was decided to pay dividends at the rates of 7½ p.ct. and 5½ p.ct. on the respective shares. An extraordinary meeting was held subsequently, at which a resolution was unanimously passed authorizing the Directors to make an application to the Board of Trade for an Order under section 10 of the Gas Regulation Act, to empower the Company to raise additional capital not exceeding £25,000, and for other purposes.

Settle.

The Settle (Yorkshire) Gas Company, at the annual meeting last week, were reported by the Directors to have made a profit of £1251, which, after deduction of interest and the addition of the surplus brought from the previous year, afforded a disposable balance of £3924. Dividends of 4 p.ct. on the cumulative preference shares and of 10 p.ct. on the ordinary shares were declared, leaving £3320 to be carried forward.

Tunbridge Wells.

The profit and loss account showed that, after providing for the payment of an interim dividend for the half-year ended June last, and other fixed charges, there was an available balance of £20,658, out of which the Directors recommended the payment of 13¾ p.ct. on the consolidated ordinary stock, 11 p.ct. on the consolidated "B" stock, and 10½ p.ct. per annum on the consolidated "C" and "D" stocks for the half-year ended Dec. 31. This absorbed the sum of £5316, leaving £15,342 to be carried forward. The quantity of gas sold showed an increase of 6½ p.ct. The Directors have decided to inaugurate a pension fund for the officers and workmen, in connection with the co-partnership scheme; and £500 has been set aside for this purpose. At the annual meeting, Mr. Harold A. Beeching (the Chairman of the Company) drew attention to the quantity of gas sold during the year, which showed an increase of 6½ p.ct., as compared with 3¾ p.ct. the previous year. The actual amount of gas sold was 437 million c.ft. Receipts for coke, tar, and sulphate of ammonia showed an increase; but the future outlook of the residuals market was not good. He was a firm believer in the principles of co-partnership. The Directors had, for some time past, been contemplating some kind of superannuation scheme, and they had come to the conclusion that it could best be worked in conjunction with the co-partnership scheme. It would be a contributory system, and the Company would duplicate the men's contributions. On a resolution being put to the meeting approving the formation of the pension fund, it was carried unanimously. The Chairman moved a vote of thanks to the officers and staff for their work during the year, to which Mr. C. F. Catt (Secretary) and Mr. L. J. Langford (Engineer) responded.

Winchester.

At the half-yearly meeting of the Company, the Chairman, Mr. J. C. Warner, referred to the sales of gas, which, he said, had increased by 7 p.ct. A great deal of work had been done in improving and developing the gas supply at Stanmore. Mr. H. C. Head, the Engineer, General Manager, and Secretary, said that last autumn a special campaign and inspection of every gas fire in the district was made; and at present they were concentrating on a similar service in connection with free installations.

GAS REGULATION ACT APPLICATIONS.

There have appeared in the "London Gazette" the following further notices regarding applications to the Board of Trade under the Gas Regulation Act.

Ormskirk and District Gas and Electricity Company.

The maximum price now authorized in respect of the supply of gas by the undertakers is 5s. 6d. per 1000 c.ft., and the price which they have asked the Board of Trade to substitute is 1s. 6d. per therm.

Prepayment meter clauses are included

Scunthorpe and Frodingham Urban District Council.

The Council are applying for an increase in the maximum price of gas authorized from 1s. 3d. to 1s. 8d. per therm, with an additional charge of 1d. per therm in respect of gas supplied by means of prepayment meters.

SPECIAL ORDER.

Great Driffield Urban District Council.

The Council intend to apply to the Board of Trade for a Special Order extending the limits of supply so as to include the parish of Nafferton; establishing the thermal basis of charge; and to substitute for the present maximum charge of 4s. 6d. per 1000 c.ft. a charge of 1s. 2d. per therm in the existing limits of supply and 1s. 4d. per therm in the added area, subject to the provision that the price in the added area shall not exceed by more than 2d. per therm the price for the time being charged in the existing limits. Provisions are also sought with regard to the conditions of gas supply, as well as in connection with the Council's borrowing powers.

DECLARATION OF CALORIFIC POWER.

Newcastle-upon-Tyne and Gateshead Gas Company.—500 B.Th.U., in substitution for 475 B.Th.U. in the Newcastle district and 525 B.Th.U. in the Walker district. (June 4.)

Steel House Maintenance.—Writing to "The Times," Mr. J. R. Goold says that "there has been destructive criticism of steel houses on the alleged high cost of maintenance. I would suggest that steel, generously coated with hot coal-tar pitch, will last for years. A special black varnish prepared from coal-gas tar would also suffice. Let the authorities experiment with these dressings."

Housing Schemes and Gas.—The Engineer (Mr. J. S. Naylor) lately submitted to the Rotherham Corporation Gas Committee a report on the cost of supplying gas mains and services to the Far Lane housing site. He stated that about 700 houses would require approximately 6000 yards of new mains, estimated to cost, with the necessary gas services, £2500. It was the intention of the Housing Committee to instal in each house two gas fires, one gas washing boiler, and the necessary piping. The Gas Committee would supply gas cooker, griller, or boiling burners, and fittings for the lighting of rooms where required in the case of prepayment meter consumers. The yearly consumption per house would average from 10,000 to 12,000 c.ft. He was of opinion that the proposals were such as might be approved by the Committee; and they endorsed this view.

EDUCATION SCHEME OF THE INSTITUTION OF GAS ENGINEERS.

GAS ENGINEERING SYLLABUS.

ORDINARY CERTIFICATE.

The Examination will include questions founded on the following subjects:

1. *Retort Setting.*—The construction and setting of retorts for the destructive distillation of coal, and the furnaces or producers for heating them.

2. *Charging and Discharging Retorts.*—The methods of charging and discharging retorts, and the machines and other tools employed; the fittings of the retort bench, including the hydraulic (or dry) main.

3. *Temperature.*—The effects of modifications of carbonizing temperature upon the quantity and quality of gas yielded by the coal.

4. *C.W.G. Plant.*—Description of apparatus for the manufacture of water gas (uncarburetted or carburetted) and the practical working of the plant.

5. *Condensation.*—The principles and methods of gas condensation, with descriptions of apparatus employed.

6. *Exhauster.*—Its construction, its use or object, and the means by which it is actuated and controlled.

7. *Purification.*—The methods of removing the gaseous impurities present in the gas after condensation, together with the apparatus and materials employed. The chemical reactions involved.

8. *Pressure and Exhaust.*—The various instruments used in gas-works for ascertaining and recording pressure and exhaust, and their practical employment and significance.

9. *Testing Gas.*—Usual methods and apparatus employed for testing coal gas, water gas, producer gas, waste gas, &c., including the usual tests for calorific value, specific gravity, and purity of the gas supplied to the public, and those for ascertaining the value of the bye-products.

10. *Principles Involved.*—The simpler physical and chemical principles involved in the ordinary processes of gas manufacture, and in the formation of the bye-products.

11. *Gasholder.*—The general principles involved in the construction of the holder and its tank. The advantages of the holder in gas distribution.

HIGHER CERTIFICATE.

In the Advanced Examination more difficult questions will be set in the subjects named in the Syllabus of the Ordinary Course, and in addition a knowledge will be required of:

1. *Properties of Coal.*—The characteristic properties of the various kinds of coal, and their value for gas-making purposes.

2. *Temperature.*—The effects of temperature upon the production of residuals.

3. *Composition and Properties.*—Chemical composition and physical properties of coal gas, and the influence of each component upon the illuminating power and calorific value of gas.

4. *Combustion.*—The principles of combustion, and their application to the working of retort furnaces.

5. *Physical and Chemical Principles.*—The more advanced physical and chemical principles involved in the process of destructive distillation of coal, and in the condensation and purification of the resulting gas.

6. *Analysis.*—The methods of complete gas analysis, including those for ascertaining the amount of impurities in the crude gas. Method of testing oil to be used in the manufacture of carburetted water gas.

7. *Gas Testing.*—Theory and practice of photometry, calorimetry, and pyrometry. Full details of apparatus employed.

8. *Power.*—Application of power and labour-saving appliances in gas-works.

9. *Construction.*—The construction of gas-works plant generally.

10. *Management.*—The management of the various portions of the plant in order to obtain the best efficiency of the apparatus with due regard to economy in working.

11. *Emergencies.*—The method of dealing with such emergencies as are of more common occurrence in gas-works through breakdown of machinery or other failure of plant.

12. *Ammoniacal Liquor.*—Working up of ammoniacal liquor and treatment of waste products.

13. *Structural Capacity.*—Working costs.

14. *Developments.*—Such important recent developments of general interest in any matters relating to gas engineering or manufacture as have been fully described in the Technical Press.

DIPLOMA COURSE.

In the Examination for the Diploma, questions will be set on the subjects specified in the Syllabuses for the Ordinary and Higher Courses, but a more exact knowledge of and experience in the subjects will be required in the answers than in the previous Courses. For example, answers to questions involving a knowledge of physics and chemistry must show that the candidate not only possesses an advanced knowledge of the principles, but also of their particular application to the process under consideration. Answers to engineering questions must show that the candidate possesses a detailed knowledge of the design and construction of all plant usually employed in gas manufacture, and that he has had experience in the working of such plant.

Powers and Prime Movers.—The thermal problems in the production of steam by solid fuels and/or waste-heat boilers. Examination of water for boilers; its suitability. Water softening and concentration of water in boilers. Power employed in gas-works practice—gas engines, electric, hydraulic, and pneumatic plants for the mechanical handling of coal, coke, residuals, &c. Influence of wear and tear.

Carbonizing.—Horizontal, inclined, and continuous and intermittent vertical systems. The use of refractory materials. The theory of thermo-chemical reactions involved in the producers and carbonizing process. Reduction of radiation losses and chemical control of working. Waste heat recovery from settings. Effects of low and high temperature on carbonizing results, with reference to the thermal production of gas and residuals. General commercial balance-sheet of the total operation involved. Steaming during carbonization. The mechanical handling, grading, and storage of coke and breeze.

Water Gas.—Carburetted water gas and total gasification plants. Types and general construction. Auxiliary powers for blasting, exhausting, &c. General construction; methods of control; thermal efficiencies with and without waste-heat boilers. Mechanical grates and water-lined generators. The valuation of gas oils and fuels. The uses of electrical pyrometers in manipulation of plant.

Condensation and Condensates.—Physical and chemical reactions involved. Tar fogs and elimination theories.

Exhausting.—By reciprocating, rotary and turbo types. Excessive and insufficient exhausting, and relative effects on production of gas and tar.

Wet Purification.—The construction of the Livesey, tower, and rotary types of centrifugal washing and scrubbing plants. Relative area—capacity to volume. Effects of temperature on washing process. Chemical aspects of crude ammoniacal liquor. Formation and uses for purification purposes. Mechanical drives, pumps, &c., used in this process.

The removal of H_2S by circulating fluids.

Dry Purification.—The construction of elevated and ground-line systems of boxes. Connections and valves. Upward and downward flows. Chemical reactions of the process with oxide, lime, &c. The uses of steam and admission of ammonia and air. The utilization of mechanical plant for charging and discharging purifiers. Spent oxide, &c., and ultimate use in chemical process.

Station Meters.—Measurements and correction of volumes by wet and dry rotary meters. The theory of electric and venturi type volume recorders. Correction of volumes. Defects developed. Testing of meters. Effect of accuracy of station meters on unaccounted-for gas.

Holders.—Column and spiral guided holders; trussed and untrussed crowns—general method of construction and materials employed. The care and upkeep of holders; external and internal preservation methods. Principles of steel, concrete, and brick and puddle tanks.

Mains on Works.—Obstructions likely to occur; methods of removal employed; arrangement and attention of works syphons.

Naphthalene.—Treatment of gas at works for removal of naphthalene. Preventive measures against corrosion in district mains, services, and consumers' meters. Initial causes in works practice rendering necessary precautionary measures.

Station Governors.—Theory of design and use. Recording gauges. Long-distance electric pressure indicators for governor rooms.

Works Distribution Methods.—Volumetric requirements. Types of turbo and rotary boosters. Gas, steam, and electric plants, for high-pressure transmission of gas.

Factory, Alkali, Locomotive, and Electric Acts and general Acts governing the working of a gas manufacturing and residual bye-products station.

Testing and Commercial Valuation of Coals.—Types of test plants and methods employed.

Sulphate of Ammonia.—General methods employed. The uses of power for large processes; open and closed saturators; the formation and uses of ordinary and neutral dry salt; purification of effluent liquors and gases; chemical problems involved. Theoretical valuation of ammoniacal liquor for sulphate production. The uses of arsenical sulphuric acid. General uses of sulphate of ammonia.

Tar Dehydration.—Types of plants employed; continuous and pot still methods; chemical production by graduated heat and effects on dehydrated tar and crude naphtha oils distilled; carbonizing influence on dehydrated tars; Ministry of Transport specifications.

Treatment of Works Ashes.—Methods adopted for the reclamation of combustible matter.

Cranes.—Loco shunting cranes and locomotives. Train system and general traction in works use.

Construction of Roads and Permanent Way.—Drainage systems and sewers on works. Construction and care in regard to effluents.

Repair Shops.—Methods of smithy, plating, and mechanical repair shops. Requirements of a modern gas-works.

General construction of plants and buildings. Foundational requirements—*i.e.*, deep and raft; the uses of ferro-concrete structures; reasons for selection of materials and metals used in structural work.

GAS SUPPLY SYLLABUS.

ORDINARY CERTIFICATE.

1. *Mains and Services.*—Station, district, and service governors. General principles of distribution. The various kinds of pipes and fittings used, and testing of same. Comparative advantages of wrought iron, cast iron, and steel. Methods of laying. Various forms of joints and methods of jointing. Protection of mains and services. Maintaining supply during alterations to existing mains and services. Making connections under pressure. Causes, preventives, and methods of dealing with corrosion and deposits. Unaccounted-for gas. Causes of, and testing for, leakage. Syphons. Valves. Main cocks. Pressure gauges. Maintenance.

2. *Meters.*—Principles and construction of station and consumers' meters. Slot and stop mechanism. Devices for ensuring accuracy of registration. Repairing, fixing, and exchanging of meters. Meter adequacy in relation to requirements. Appliances required for, and regulations governing, official tests of meters. The reading of meters—examination for illicit connections—testing meters *in situ*.

3. *Properties of Materials.*—Composition of various alloys, such

as brass, gun-metal, &c., used for valves, cocks, gas fittings, &c. Solders, their composition, preparation, and uses.

4. *Interior Fittings.*—Description and size of pipes in relation to requirements. Distribution of light. Testing of installations. Fittings and accessories. Simple principles of ventilation. Methods of governing pressure at or beyond the meter.

5. *Luminous and Bunsen Flames.*—Theory and application.

6. *General Lighting.*—Construction and efficiencies of regenerative and incandescent burners. Regulation of gas and air supply to burners. Causes and prevention of mantle breakages. Influence of shades, globes, wallpapers, &c., and the arrangement of the lighting units, on light efficiency.

7. *Outside Shop and Street Lighting.*—Types and construction of lanterns, including burners and other fittings. Principles of windproof lanterns. Suspension brackets and lamp pillars..

8. *Use of Gas as a Fuel.*—Construction, types, and fixing, of cookers, boilers, fires, radiators, irons, water-heating appliances, &c. The construction and fixing of flues for waste products. Industrial appliances—furnaces, ovens, crucibles, blowpipes, &c.

9. *Gas Power.*—Construction, fixing, and management of the gas engine.

10. *Tools and Appliances.*—Description and uses of all tools and appliances necessary for installation and repair work from the works governors to the point of combustion.

11. *Simple Calculations.*—In light distribution; thermal efficiencies; and ventilation.

HIGHER CERTIFICATE.

In the Advanced Examination more difficult questions will be set in the subjects named in the Syllabus of the Ordinary Course, and in addition a knowledge will be required of:

1. *Mains and Services.*—Effects of pressure on bulk and on discharge. Pressures and pressure-recording instruments. "First aid" in cases of "gassing." Districting. Distance pressure signalling. Subways, advantages and disadvantages of. The carrying of mains over bridges, and under rivers and canals. Explosive mixtures. Records. Plans. Maps. Surveys.

2. *Interior Fittings.*—Specifications. Carcassing of premises—the effect of inadequate sized pipes. Testing pipes and fittings for soundness; searching for escapes; precautions against accidents.

3. *General Lighting.*—Principles and construction of various types of burners and plant for intensified lighting. Manufacture, composition, and testing of the incandescent mantle. Illuminating effect of different methods of lighting. Comparative costs of various illuminants. Planning or re-arrangement of lighting installations. The hygiene of gas for lighting.

4. *Interior Lighting.*—Lighting of churches, factories, railway stations, and other large buildings. The Home Office Report on Factory Lighting. Theory and practice of ventilation by gas. Lighting for special purposes, such as hospital wards, shop windows, billiard tables, &c. Switch and other systems of distance lighting.

5. *Outside Shop and Street Lighting.*—Public lighting. Outside shop window lighting. Testing for illuminating power and illuminating effect. Advertising and illuminating devices. Automatic lamp-lighting appliances.

6. *Influence of Reflection on Indoor and Outdoor Lighting.*—The reflecting powers of various surfaces and the means of ascertaining same. Indirect and semi-indirect methods of lighting.

7. *Gas Used for Heating Purposes.*—Industrial and domestic uses of gas. Influence of air supply and flame temperature. Arguments in favour of gaseous *versus* solid fuel. The hygiene of gas for cooking and heating.

8. *Gas Power.*—Meaning and measurement of calorific power. Comparative costs and thermal and mechanical efficiencies of the town gas engine and competing power agents. Importance of proper mixtures, correct timing of valves, thorough scavenging, &c. Avoidance of vibration in running—avoidance of fluctuations in supply mains. Gas-driven electricity plant—costs of installation and running—conditions favourable to their installation.

9. *Physics and Chemistry as Applied to Lighting and Heating.*—Temperature, radiation, conduction, convection, reflection, and refraction. Diffusion and humidity. Instruments used for investigation, such as spectroscopes, hygrometers, and thermoscopic appliances.

10. *Gas in Competition* for light, heat, and power.

11. *Maintenance of Fittings and Apparatus.*—The adjustment of defective burners, stoves, and other appliances. The effect of dirt upon the illuminating efficiency of lamps and the heating efficiency of bunsen burners.

12. *High-Pressure Gas.*—Principles involved. Fans, rotary and reciprocating compressors. Effect of compression on the composition and volume of the gas. Avoidance of oscillation. Apparatus used in high-pressure distribution. Laying and jointing mains for high-pressure distribution. Service attachments. Meters, burners, lamps, governors, distance control, safety devices, boosting, industrial applications.

DIPLOMA COURSE.

In the Examination for the Diploma more difficult questions will be set in the subjects named in the Ordinary and Higher Course Syllabuses; and in addition a knowledge will be required of:

Mains.—Flow of gas in mains, theory and practice. Main-laying costs in relation to prospective revenue. Electrolysis and electric fusion.

General Lighting.—Theory of the incandescent mantle. Flame temperature. Flame propagation. Principles of illumination. Measurement of illumination, both interior and exterior. Combustion in its various forms.

Gas for Heating.—Furnaces for industrial use; theory and practice of construction. Refractory materials in connection therewith. Influence of, and remedies for, inconstant mixtures. Testing of temperatures. Working results. Testing of fires, cookers, and other appliances for thermal and hygienic efficiency.

Statutory Enactments, &c.—General legal obligations affecting gas supply. Factory and Workshops Acts, so far as they affect the use of gas. Relative fire risks of various methods of lighting and heating; and effect on insurance rates.

Recent Developments.—Such important recent developments of general interest in any matters relating to gas supply as have been fully described in the Technical Press.

TRADE NOTES.

Building & Engineering Contractors, Ltd.

This Sheffield firm have just issued a brochure giving particulars and illustrations of certain of the work which they have recently completed. The examples selected indicate the varied nature of the building and constructional steelwork which the firm are prepared to design and erect. It may be mentioned that the firm have recently acquired an engineering works in the Rotherham district.

Fixing of Geysers.

Recognizing that the proper fixing of a geyser is of the utmost importance to ensure satisfactory results, Messrs. Ewart & Son, Ltd., of Euston Road, London, N.W., have, for the assistance of architects, compiled a short specification for fixing some of their standard types of geysers. These are fully guaranteed to perform up to their catalogue capacity; but they must be fitted with the proper gas and water services, and suitable ventilating pipes.

CONTRACTS OPEN.

Coal.

Tenders are being invited by the Directors of the Wrexham Gas Company for the supply of from 12,000 to 13,000 tons of gas coal. (See advert. on p. 626.)

Cast-Iron Pipes (Supplying and Laying).

The Gas Department of the County Borough of Walsall are prepared to receive tenders for the supply and laying of cast iron mains, together with the necessary syphon boxes, connections, &c. (See advert. on p. 626.)

EXTENSIONS.

Dewsbury Carbonizing Plant.

The Dewsbury Corporation have received the sanction of the Ministry of Health to the borrowing of £33,000 for the installation of new horizontal retorts and other plant at the gas-works.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *March* 9.

Pitch continues quiet, and very little business is offering. The price is nominal at from 42s. 6d. to 45s. net per ton at works.

Creosote is quiet at about 7⅞d. to 7¾d. net per gallon.

Tar spirits are firm; solvent 95/160 naphtha being 1s. 8d. per gallon, and pure benzole and pure toluole about 1s. 10d. per gallon.

Tar Products in the Provinces

March 9.

The markets for tar products generally are still very dull.

In pitch, the market has receded somewhat, and business has been reported at 40s. f.o.b. East Coast, and at 41s. at one of the best ports. On the West Coast there is little or no business doing.

Creosote is steady. There is still a fair demand from abroad, and prices are well maintained.

Crude carbolic is very quiet indeed. Business is reported as low as 1s. 5d. per gallon for 50's.

Cresylic acid is quiet, and sales are still very difficult to negotiate.

Benzole, toluole, and solvent naphtha are all firm at unchanged prices.

Crude naphthalene is still neglected.

The average values for gas-works products during last week were: Gas-works coal tar, 29s. 9d. to 34s. 9d. Pitch, East Coast, 40s. to 41s. f.o.b. West Coast—Manchester, 35s. to 36s.; Liverpool, 36s. to 37s.; Clyde, 39s. to 40s. Benzole, 90 p.c., North, 1s. 7½d. to 1s. 8½d.; crude, 65 p.c., at 120° C., 9½d. to 10½d., naked at makers' works; 50-90 p.c., naked, North, 1s. 2d. to 1s. 3d. Toluole, naked, North, 1s. 7½d. to 1s. 8½d., nominal. Coal-tar crude naphtha, in bulk, North, 7½d. to 8d. Solvent naphtha, naked, North, 1s. 5d. to 1s. 6d. Heavy naphtha, North, 1s. 1d. to 1s. 2d. Creosote, in bulk, North, liquid, 6⅝d. to 6¾d.; salty, 6½d. to 6⅝d.; Scotland, 6½d. to 6⅝d. Heavy oils, in bulk, North, 6¾d. to 7d. Carbolic acid, 1s. 6d. to 1s. 7d. prompt. Naphthalene, £12 to £15; salts, £4 to £5, bags included. Anthracene, "A" quality, 3d. per minimum 40 p.c., purely nominal; "B" unsaleable.

Price and Profits at Coalville.—The Coalville Urban Council have decided to reduce the price of gas by 2½d. per 1000 c.ft., as from April 1. At the same time they agreed to transfer £1000 from the gas-works to the general account for the relief of the rates.

New Showrooms and Offices at Cardiff.—On March 2 the Cardiff Gas Company moved into their new Penarth showrooms and offices in Stanwell Road. The increasing demands of the public made a removal from the Windsor Road offices desirable. The new premises have double plate windows, each 13 ft. by 11 ft., looking on to Stanwell Road; and the setting is in ornate stone. There is a 34 ft. frontage, and the entrance is picked out in gilt. The whole of the ground floor will be given over to offices, showrooms, and stores. The Company had a full-page advertisement in the "Penarth News" for March 5, explaining to the public that all that is modern and efficient in gas appliances can be seen at their new showrooms.

NORTH-EAST COAST COAL TRADE.

From our Own Correspondent.

The past week has seen still more depressing conditions in the market. In spite of the further closing of collieries, actual and imminent, and of almost general short-time working, the supply considerably exceeds the demand.

Reports from France continue to show increasing outputs and diminishing imports—January broke all records for that country.

Prices, even at the present lower levels, are only maintained by collieries having to make a stand somewhere, and, when they cannot obtain their minimum, they lie idle.

Gas coals, like nearly all others, have inclined easier on the week. Wear Specials were quoted at the finish at about 21s., and best qualities at 20s. 6d. to 20s. 9d. These prices are only nominal, and spot business can probably be done at less. Other makes were obtainable in some cases as low as 17s., and reasonably good quantities at 17s. 6d. to 17s. 9d. Good coking unscreened makes were to be had at 17s. 3d. to 17s. 6d., and best qualities at about 17s. 9d. Durham unscreened steam for bunkers is in little demand, and best makes find difficulty in getting 18s. 6d. f.o.b.

COAL TRADE IN THE MIDLANDS.

From our Local Correspondent.

The market position is certainly no better. Values are weak and irregular. Prices appreciably below the level which is generally recognized by sellers are accepted by collieries that find themselves in a tight place. The house coal trade remains as flat as ever. Quotations show firmness only in regard to best grades, and these are not being taken up as fast as they can be produced. For second qualities there is little inquiry. Stocks on the wharves are being moved but slowly, and merchants do not like the outlook. The industrial demand is fluctuating. In the Birmingham area there has been rather more activity recently; but, taking a wider survey, it is found that the volume of demand is almost stationary. The heavy industries remain stagnant. While slacks and D.S. nuts are selling fitfully in the manufacturing districts, the aggregate of business has fallen off, and lower prices have had to be accepted to secure outlets. Many of the pits are now reduced to four or four-and-a-half days' work a week.

There is an excess of gas coke in not a few directions, and price cutting has not abated. Furnace coke values are prevented from collapsing by a curtailment of output. Some producers who did not avail themselves of the opportunities of selling forward in December continue to put coke on the market at cut prices; but the competition for the small amount of business doing is very restricted.

YORKSHIRE AND LANCASHIRE COAL TRADE.

From our Local Correspondent.

Gas coals in Yorkshire and Lancashire are moving regularly under contract, with indications of renewed contract business at reduced prices.

There is no apparent improvement in the general situation of the coal market in these counties. There has been a slight increase in the demand for household fuel—the result of the recent snap of cold weather—but prices remain unaltered.

Industrially, there is no change in the position; and while spot lots of steam-raising fuel of the commoner grades are available at low figures, there is no indication that these are being taken advantage of to any great extent.

The export section still remains dull, with no prospect of immediate improvement.

Harpenden Debenture Tenders.—The tenders for the £13,951 of 6 p.ct. redeemable mortgage debentures which Messrs. A. & W. Richards offered on behalf of the Directors of the Harpenden District Gas Company amounted to £42,550, and ranged from £102 10s. down to the minimum of par. The lowest price to secure allotment was £101 p.ct.; the average figure obtained for the issue being £101 3s. 3d.

Dublin Gasfitters' Strike.—The outdoor gasfitting staff of the Alliance and Dublin Consumers' Gas Company went on strike last week, because the Company refused payment for time not worked owing to weather conditions. About 300 men engaged in the Company's street services were involved, and operations were held-up for a day, when negotiations led to an amicable settlement, and work was resumed.

Gas Lecture to Dewsbury Rotarians.—Mr. H. L. Bateman (the Borough Gas Engineer and Manager) addressed the Dewsbury Rotary Club on the 2nd inst. on "The Gas Industry and Gas Service." Alderman W. Naylor presided. Mr. Bateman reviewed the history of gas production from coal, and remarked that the public were only just beginning to realize the importance of the smoke problem. Carbonization of coal for gas manufacture was the most efficient method of coal treatment yet known. He remarked on the conveyance of gas to the point of usage without adding to traffic problems; on its steady quality and quantity without the necessity of storage accommodation by the user; on the absence of labour or attention on the part of the consumer; and on its complete control and regulation according to the user's need. Referring to the vastness of the industry, Mr. Bateman related something of the history of gas making at Dewsbury, and gave statistics of the service to the 15,822 consumers.

THE GAS FIRE METER.

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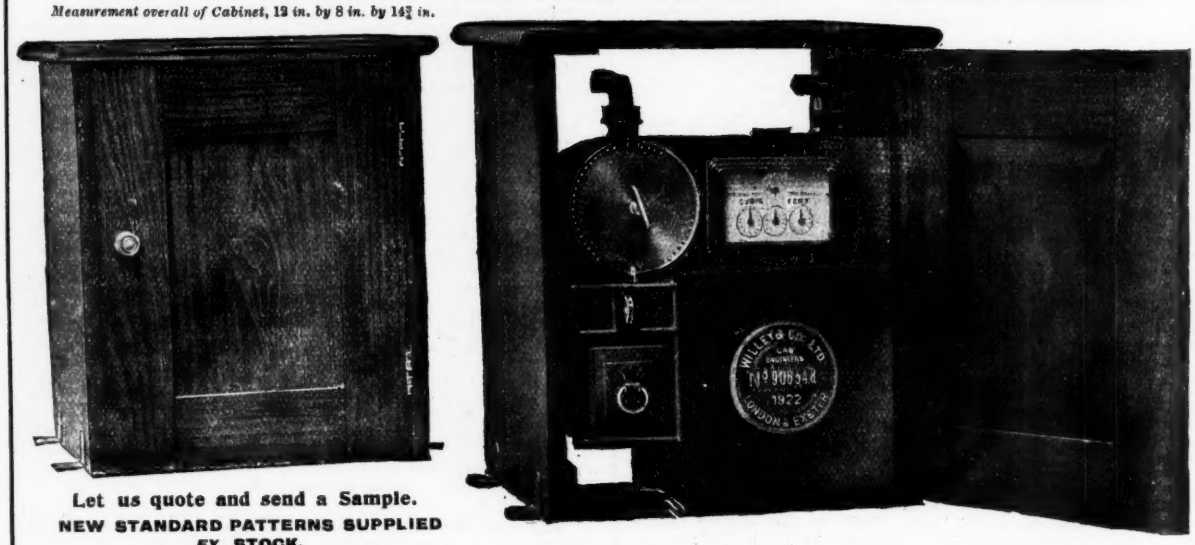

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Borrowing Powers at West Bromwich.—The West Bromwich Town Council, at their meeting last Wednesday, decided to apply to the Ministry of Health for an Order to increase the borrowing powers of the Gas Department by £100,000.

Lurgan Gas-Works Loss.—In a discussion in the Lurgan Urban District Council regarding the loss on the working of the gas undertaking, Mr. Tallentire recalled that the Council had permanently reduced the price of gas by 9d. per 1000 c.ft., which involved an amount of £1174, while a loss of £1000 had been incurred by reason of a supply of inferior quality coal.

Gas Fires for the East.—A sign of the times is afforded by the fact that a well-known firm of English gas fire manufacturers (Radiation, Limited) have just shipped 600 "injector-ventilator" gas fires to Japan. A large number of these stoves were recently exported to Colombo. They are required for domestic purposes (replacing the traditional charcoal fire), as well as for the modern business premises.

Maclaurin Plant at Glasgow.—The Glasgow Gas Committee have had submitted to them a report by the Manager (Mr. J. W. M'Lusky) with regard to the method to be adopted for the treatment of crude oil from the Maclaurin low-temperature carbonization plant being installed at the Dalmarnock Gas-Works. The Committee, after consideration, agreed that it be remitted to the Manager and Mr. Maclaurin to instal plant at the Dalmarnock Chemical Works sufficient for the purpose of testing the commercial possibilities of the products obtainable from the crude oil and from the ammoniacal liquor.

Gas Mantle Duty.—Importers and distributors of incandescent gas mantles, meeting last Monday at the offices of the London Chamber of Commerce, considered a report that the first Committee of Inquiry under the Government's new Safeguarding of Industries policy are to be asked to deal with an application for a duty of 10s. per gross to be imposed on imported gas mantles. According to the "Financial Times," a resolution was passed expressing surprise that the Board of Trade should contemplate tariff protection for the gas mantle industry, "which does not give employment to more than 2500, and which is in all countries a dying industry."

Lancaster Corporation Gas-Works.—The financial statement made at the budget meeting of the Lancaster Town Council on the 4th inst. showed that the undertaking had an income of £67,410 last year, while the expenditure totalled £65,217. The estimated income for 1925-26 is £65,380, and the expenditure £65,033; but the members of the Council said the Gas Committee were always crying "Wolf," and they expected £2000 profit, instead of £347. Mr. Till (the Chairman) said the receipts were £13,254 less than the previous year, and the expenditure £11,373 less He explained that the price of gas was reduced to 2s. 11d. per 1000 c.ft. The estimates were accepted, with the Finance Committee's recommendation to take £2000 profits for the rates.

Gas-Workers' Strike at Cambridge.—A strike of about 150 members of the National Union of General Municipal Workers employed by the Cambridge University and Town Gas Company took place on March 3, on the question of working with non-unionists. The dispute was one among the men themselves. For some time there has been friction because twenty men refused to join the Union. A letter was sent to each non-unionist, but this failed to bring them into line. It was an unofficial strike, but the Union subsequently took it up. At the request of the Union officials, the Directors agreed that all the men, with the exception of five, should be allowed to return to work.

Preston Gas Company's Powers.—The Preston Corporation are not proceeding further with their objections to the Gas Company's application for an Order under the Gas Regulation Act; the Company agreeing that the working-up of residuals shall only be authorized on new lands of 33 acres acquired by them at Walton-le-Dale. The Company also withdrew their suggestion for the repeal of an old power which the Corporation have of appointing an inspector of meters. The Company could not agree to the Corporation's proposal to transfer the whole of their plant to new land. They pointed out that the new plant at Walton-le-Dale would relieve the existing works of future increases, and that to this extent there would not be any ground for complaint. No inquiry was held.

Joymanco (Brighton), Ltd.—Mr. H. J. Green (the Chairman), presiding at the annual meeting of this Company, held at Hove on the 4th inst., gave a very satisfactory report of the business for the year ended Dec. 31. The total sales had increased by 50 p.ct., and extensions had been made both to plant and premises, to cope with the increased demand. Despite the fact that there had been no reduction in labour costs, and all materials had increased considerably, the profits had been well maintained, owing to improved methods of production; and the amount available at the credit of profit and loss account was nearly doubled. A dividend of 8 p.ct., free of tax, was declared, after which an amount greatly exceeding that of the previous year was carried forward. After the meeting, the shareholders and a number of friends were entertained at dinner at the Royal York Hotel, Brighton.

Messrs. Heywood & Son offered for sale at Stone last week fifteen £5 fully paid shares in the Stone Gas and Electricity Company, Ltd., which realized £8 10s. each.

The Belfast and District Chamber of Trade have accepted the invitation of the Engineer (Mr. J. D. Smith) to pay a visit of inspection to the City Gas-Works in April.

The Oldham Gas Committee having had a discussion as to whether it would not be advantageous to dispense with the making of gas at one or more of the works, and confine the manufacture to one centre, it was decided to engage the services of an expert to examine fully into the question, and report as to the advisability of consolidating the gas undertaking.

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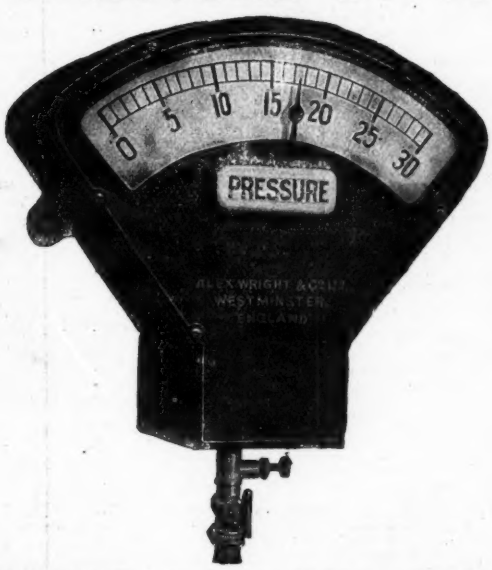

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STOCK MARKET REPORT.

THE anticipated rise in the Bank Rate to 5 p.ct. is understood to indicate the determination of the Treasury and the Bank of England to bring about a return to the gold standard, and it is expected that any disadvantages to the trading interests will be nullified by the benefits that will accrue. The disadvantages, as illustrated by dear money, are immediately apparent, and both traders and investors will await with some anxiety for signs of the potential benefits.

On the Stock Exchange the general depression continued, prices being marked down impartially. War Loan was at one time as low as 100¾, although it improved later. The recent Trading Facilities issues fell to 2 discount.

Attention has been drawn to the variations in the yields of the popular industrials. Courtaulds, Bradford Dyers, British American and Imperial Tobaccos yield something in the region of 6 p.ct. gross, but apparently investors and J. & P. Coats are satisfied with £5 7s. 3d. p.ct. per annum, and in the case of Fine Cotton Spinners £4 10s. p.ct. only, for which low return there is apparently no satisfactory explanation.

As our readers are aware, Gas Stocks are rarely affected by outside conditions, but it was not to be expected that the sudden change in the value of money would leave them unscathed. The numerous changes in the quotations last week are mainly due to *ex* dividend marking-down. This, however, does not wholly account for a drop of 5 points in the Brentford two capital stocks on an actual dividend of £3 1s. and £3 1s. 3d. respectively, although it may account for the further fall of 2 points in the Gas Light ordinary. On the other hand, Cardiff ordinary made an extraordinary jump of 6 points, to 101-104.

The following transactions were recorded during the week:

On Monday, Bombay 5⅜, Bristol (5 p.ct. max.) 96 *ex* div., British 115½, 117½, European 7½, Gas Light and Coke 90¼, 91, 91¼, 91⅜, 91½ *ex* div., 3½ p.ct. maximum 63¼, 64 *ex* div., 3 p.ct. debenture 61½, Hastings and St. Leonards 5 p.ct. converted 97, 97½, Montevideo 63, 63¾, Primitiva 8s. 9d., 9s. 4½d., South Metropolitan 97⅜, 98½ *ex* div., Tottenham "A" 118 *ex* div., "B" 101 *ex* div. Supplementary prices, Dover 5¼ p.ct. debenture 103.

On Tuesday, Bombay 5 5/16, European 7½, Gas Light and Coke 89½, 90, 90½, 91 *ex* div., 3 p.ct. debenture 60, 60¾, 61, Hastings and St. Leonards 5 p.ct. converted 97½, Primitiva 8s. 6d., 8s. 9d., South Metropolitan 97½, 98⅛, 98¼ *ex* div., 3 p.ct. debenture 60½, 61. Supplementary prices, Brentford 6 p.ct. mortgages 99, Croydon 7½ p.ct. preference 102½, 102¾.

On Wednesday, Alliance and Dublin 69, 70, Brentford 4 p.ct. debenture 81, Gas Light and Coke 89½, 89¾, 90, 90½, 90¾, 91 *ex* div., 3½ p.ct. maximum 63¾ *ex* div., Imperial Continental 178½, Plymouth and Stonehouse 109½, Primitiva 8s. 3d., 8s. 9d., South Metropolitan 96½, 97, 97½, 97⅝, 98, 98¼, 98⅜ *ex* div., Wandsworth (Wimbledon) 112½. Supplementary prices, Watford 3½ p.ct. "B" 94, 94½.

On Thursday, Brentford "B" 108 *ex* div., Commercial 4 p.ct. 93 *ex* div., 3½ p.ct. 91½ *ex* div., European 7½, Gas Light and Coke 89½, 89⅝, 90, 90½, 90⅝, 90¾, 90⅞, 3½ p.ct. maximum 63, 3 p.ct. debenture 60½, Imperial Continental 177, 178½, 179, Plymouth and Stonehouse 110, Primitiva 8s., 8s. 7½d., South Metropolitan 96, 96½, 97, 97½, 97⅝, 98¼, 3 p.ct. debenture 60, 61½ p.ct. debenture 103, 103½ *ex* div., Swansea 6½ p.ct. debenture 103⅜, Wandsworth (Epsom) 124 *ex* div. Supplementary prices, Liverpool 5 p.ct. 88½.

On Friday, Brentford 4 p.ct. debenture 79, 79½, Bristol 96, Commercial 4 p.ct. 94½ *ex* div., Gas Light and Coke 89⅜, 90¼, 90⅜, 90½, 90⅝, 91, 91¼, 91½, 4 p.ct. preference 79, Maidstone 5 p.ct. 124, 124½, Primitiva 8s. 3d., 8s. 7½d., South Metropolitan 97, 97⅛, 97¼, 97½, 98. Supplementary prices, Kingston-upon-Thames 104½, 104¾.

There was an influx of foreign money into the London market at the end of the week in consequence of the higher Bank Rate, and funds, assisted by Railway dividend distribution, were in good supply. For old day-to-day loans 3½ p.ct. was generally paid. The average rate obtained for Treasury Bills was £4 8s. 5·34d., as compared with £4 12s. 9·23d. the previous week.

The most important movement in the Foreign Exchange market was the recovery in the franc. The cheque closed at 92.22½ on Friday. Belgians improved in sympathy to 94.35. Italian lire declined to 116.56. Sterling on New York, although strong early in the day, closed at 4.76 13/16.

Silver was firmer on Indian purchases, and the price rose to 32½d. per oz. for cash. Gold was slightly lower at 86s. 8d.

The Bank Rate is 5 p.ct., to which it was raised from 4 p.ct. on Thursday last. Bankers' deposit rates are 3 p.ct. The deposit rates of the discount houses are 3 p.ct. at call and 3½ p.ct. at notice.

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf.Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. Mar. 6.	Rise + or Fall − on Week.	Transactions Lowest and Highest Prices.
£			% p.a.	% p.a.				
171,978	Stk.	Feb. 5	5	5	Aldershot 5 p.c. max. C.	78—81	..	..
235,492	,,	,,	4	4	Do. 4 p.c. Pref.	71—76	..	..
1,551,868	,,	Sept. 25	6	6½	Alliance & Dublin Ord.	65—70	..	69—70
374,000	,,	Jan. 8	4	4	Do. 4 p.c. Deb.	61—66	..	..
300,000	5	Oct. 23	8	8	Bombay, Ltd.	4—5¼	..	5 1/16—5⅛
100,000	10	Mar. 5	8½	8½	Bournemouth 5 p.c.	12—13*	−½	..
425,050	10	,,	7	7	Do. B 7 p.c..	12½—12¾*	−¼	..
150,000	10	,,	6	6	Do. Pref. 6 p.c..	10¾—11½*	−½	..
50,000	Stk.	Jan. 8	3	3	Do. 3 p.c. Deb..	56—59	..	..
162,025	,,	,,	4	4	Do. 4 p.c. Deb..	76—79	..	..
992,045	,,	Mar. 5	6 1/16	6 1/16	Brentford A Con.	105—110*	−5	..
990,500	,,	,,	6⅛	6⅛	Do. B New	105—110*	−5	108
76,000	,,	,,	5	5	Do. 5 p.c. Pref.	89—94*	..	..
306,690	,,	Dec. 18	4	4	Do. 4 p.c. Deb.	76—81	..	79—81
181,337	,,	,,	6	6	Do. 6 p.c. Rich. Red. Deb.	100—105	..	..
214,740	,,	Mar. 5	11½	12½	Brighton & Hove Orig.	165—170*	−5	..
244,200	,,	,,	8½	9½	Do. A Ord.	122—125*	−3	..
1,287,500	,,	Feb. 19	5	5	Bristol 5 p.c. max.	96½—97⅛*a	+½	96
855,000	,,	Sept. 25	7	8	British Ord.	115—120	..	175½—177½
100,000	,,	Dec. 18	7	7	Do. 7 p.c. Pref.	123—128	..	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	72—77	..	..
100,000	10	Dec. 18	8	6	Cape Town, Ltd.	7—8	..	..
100,000	10	Nov. 6	4½	4½	Do. 4½ p.c. Pref.	6—7	..	..
150,000	Stk.	Dec. 18	4½	4½	Do. 4½ p.c. Deb.	71—76	..	..
626,860	,,	Feb. 19	6	6	Cardiff Con. Ord.	101—104	+6	..
237,860	,,	Jan. 8	7½	7½	Do. 7½ p.c. Red. Deb.	105—108	..	..
157,150	,,	Feb. 19	5	6½	Chester 5 p.c. Ord.	89½—94½*b	..	..
1,513,280	,,	Mar. 5	6	5/14/8	Commercial 4 p.c. Cap.	92—95*	−2	93—94½
560,000	,,	,,	6	5⅝	Do. 3½ p.c. Cap.	91—94*	−3	91½
475,000	,,	Dec. 18	3	3	Do. 3 p.c. Deb.	57—60	..	..
800,000	,,	14 Jan. 15	—	—	Continental Union, Ltd.	39—44	..	..
200,000	,,	Dec. 18	7	7	Do. 7 p.c. Pref.	88—92	..	..
660,000	,,	Mar. 5	6½	6½	Croydon sliding scale	100—103*	−2	..
284,975	,,	,,	5	5	Do. max. div.	83—86*	−2	..
492,270	,,	Feb. 19	6	9	Derby Con.	110—112*c	..	..
55,000	,,	Jan. 8	4	4	Do. Deb.	74—76c	..	..
1,002,180	1	Jan. 22	6	4	European, Ltd.	7⅛—8⅛	−¼	7⅛
16,460,070	Stk	Feb. 19	5⅓	5⅓	Gas Light & Coke 4 p.c. Ord.	89—92	−2	89½—91½
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	62—65	..	63—64
4,062,235	,,	,,	4	4	Do. 4 p.c. Con. Pref.	79—81	..	79
4,761,930	,,	Dec. 18	3	3	Do. 3 p.c. Con. Deb.	59—62	−1	60—61½
130,000	,,	—	10	10	Do. 10 p.c. Bonds	..	..	..
42,000	,,	—	7½	7½	Do. 7½ p.c. Ilford Deb.	..	..	..
82,500	,,	Sept. 11	6½	6½	Hastings & St. L. 5 p.c. Conv.	95—100	..	97—97½
258,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	75—80	..	..
70,000	10	Sept. 25	10	10	Hongkong & China, Ltd.	16—17	..	..
86,600	Stk.	Mar. 5	10	10	Hornsey 7 p.c.	138—143*	−4	..
1,976,000	,,	Nov. 20	30	10	Imperial Continental Cap.	175—180	..	177—179
263,950	,,	Feb. 5	3½	3½	Do. 3½ p.c. Red. Deb.	71—74	..	..
235,242	,,	Aug. 14	6½	6½	Lea Bridge 5 p.c. Ord.	98—103	..	..
2,127,340	,,	Feb. 19	5½	5½	Liverpool 5 p.c. Ord.	88—89b	−1½	88½
600,000	,,	Sept. 25	7	7	Do. 7 p.c. Red. Pref.	106—109b	..	..
165,736	,,	Feb. 19	9	8	Maidstone 5 p.c. Cap.	122—132	..	124—124½
63,480	,,	Dec. 18	3	3	Do. 3 p.c. Deb.	54—59	..	..
75,000	5	Dec. 4	7	5	Malta & Mediterranean	4—4½	..	..
341,920	Stk.	Nov. 20	4	4	Montevideo, Ltd.	62—67	..	63—63⅜
2,061,315	,,	Mar. 5	5	5	Newcastle & Gateshead Con.	82½—83½*d	−3	..
300,929	,,	,,	4	4	Do. 4 p.c. Pref.	72½—73½*d	−1½	..
329,705	,,	Dec. 18	3½	3½	Do. 3½ p.c. Deb.	68—69d	..	..
15,000	10	Mar. 5	11	12	North Middlesex 10 p.c.	15½—16½*	−½	..
75,940	10	,,	7 7/16	8⅜	Do. 7 p.c.	11—11½*	−½	..
300,000	Stk.	Dec. 4	7	9	Oriental, Ltd.	100—105	..	..
138,120	,,	Jan. 8	7¼	7½	Plym'th & Ston'house 5 p.c.	109—114	..	109½—110
60,000	50	Mar. 5	13	14	Portsea Island B	96—99*	−3	..
100,000	50	,,	12	13	Do. C	93—98*	−2	..
2,289,909	1	—	—	—	Primitiva Ord.	8/0—9/0	−1/3	8/0—9/4½
311,100	100	Dec. 1	4	4	Do. 4 p.c. Red. Deb.	78—80	..	..
600,000	Stk.	Jan. 22	4	4	Do. 4 p.c. Red. Deb. 1911	63—65	..	..
220,335	,,	Dec. 18	4	4	Do. B. Aires 4 p.c. Rd. Db.	65—67	..	..
321,670	,,	,,	4	4	Do. R'r P'te 4 p.c. Rd. Db.	65—67	..	..
150,000	10	Sept. 25	6	6	San Paulo 6 p.c. Pref.	7⅞—8⅛	..	..
125,000	50	Jan. 2	5	5	Do. 5 p.c. Red. Deb.	43—46	..	..
270,000	Stk.	Aug. 28	5/8/4	5⅛	Sheffield A	104—106e	..	..
419,968	,,	,,	5/8/4	5⅛	Do. B	104—106e	..	..
1,047,000	,,	,,	5/8/4	5⅛	Do. C	104—106e	..	..
90,000	10	Oct. 23	8	6	South African	7—9	..	..
6,609,895	Stk.	Feb 19	5	6½	South Met. Ord.	96—99	−1½	96—98½
1,895,445	,,	Jan. 8	3	3	Do. 3 p.c. Deb.	59—62	..	60—61
734,000	,,	Mar. 5	6½	6½	Do. 6½ p.c. Red. Deb.	102½—104½*	−2½	103—103½
91,500	,,	Mar. 5	8½	8½	South Shields Con.	135—136*d	−4½	..
1,187,795	,,	Feb. 19	6½	6½	South Suburban Ord. 5 p.c.	105—110	..	..
368,837	,,	Dec. 18	5	5	Do. 5 p.c. Deb.	97—100	..	..
647,740	,,	Nov. 6	5	5	South'mpt'n Ord. 5 p.c. max.	83—86	..	..
121,275	,,	Dec. 18	4	4	Do. 4 p.c. Deb.	72—77	..	..
250,000	,,	Mar. 5	7	7	Swansea 7 p.c. Red. Pref.	101—103*	−3	..
200,000	,,	Dec. 18	6½	6½	Do. 6½ p.c. Red. Deb.	102—104	..	103½
120,000	,,	Feb. 19	8	8	Tottenham District A 5 p.c.	116—119	..	118
882,275	,,	,,	6½	6½	Do. B 3½ p.c.	100—103	..	101
181,255	,,	Dec. 18	4	4	Do. 4 p.c. Deb.	75—79	..	..
258,251	,,	Aug. 28	7/14/4	5	Tynemouth Con. and New Uxbridge, Maidenhead, & Wycombe 5 p.c.	100—105	..	..
187,294	,,	Feb. 19	6½	6½	Do. 5 p.c. pref.	93—98	..	..
68,330	,,	,,	5	5	Do. 5 p.c. Maidenh'd	90—95	..	..
91,800	,,	,,	—	6½	Wandsworth, Wimbledon, and Epsom—			
30,000	,,	Mar. 5	9½	9½	Wandsworth A 5 p.c.	135—140*	−3	..
255,636	,,	,,	7½	7½	Do. B 3½ p.c.	114—119*	−3	..
108,075	,,	,,	6/7/9	6/9/6	Do. C	97—102*	−3	..
284,880	,,	—	6/7/9	6/9/6	New Ordinary	..	..	..
352,000	,,	,,	7½	7½	Wimbledon 5 p.ct.	109—114*	−3	112½
98,000	,,	,,	7½	7½	Epsom 5 p.ct..	117—122*	−3	124
88,416	,,	Dec. 18	3	3	5 p.c. Deb.	57—60	..	..

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